

PUBLIC SCHOOL
ARITHMETIC

SMITH & ROBERTS

BOOK II

W. J. GAGE & COMPANY
LIMITED

~~Lester Beech~~

~~Lester Beech~~

~~Lester Beech~~

$$63 = 7 \times 9$$

$$= 3 \times 3 \times 7$$

$$72 = 8 \times 9$$

$$2 \times 2 \times 2 \times 3 \times 3$$

$$84 = 7 \times 12$$

$$2 \times 2 \times 2 \times 2 \times 3 \times 7$$

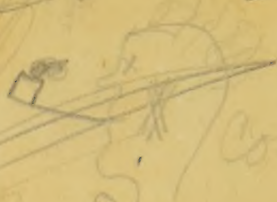


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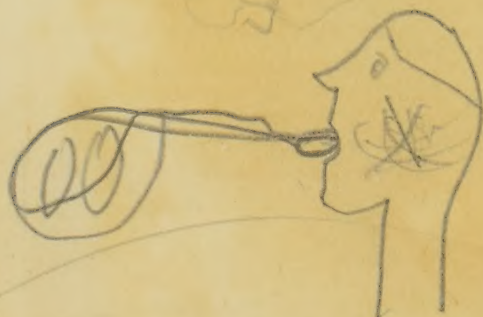


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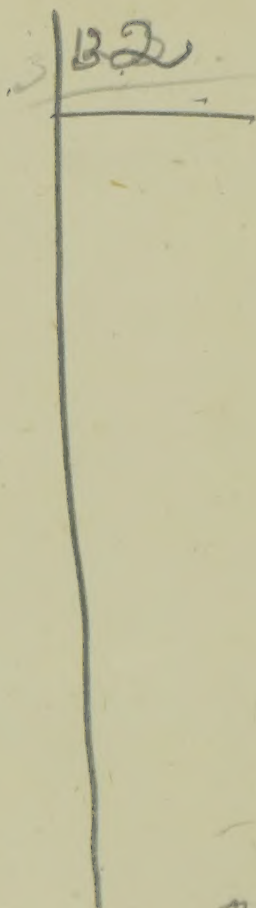
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35. Tch row



1002 10X10

2x5 135

2x2 15+5

GAGE'S EDUCATIONAL SERIES

ARITHMETIC

BOOK II

BY

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*AUTHORIZED IN SEPARATE EDITIONS FOR USE IN
BRITISH COLUMBIA, ALBERTA, MANITOBA,
QUEBEC, AND NOVA SCOTIA*

TORONTO

W. J. GAGE & COMPANY, LIMITED

1928

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ARITHMETIC

BOOK II

CHAPTER I

GENERAL REVIEW

Notation and Numeration

Point off the following numbers, and read :

	<i>A</i>	<i>B</i>	<i>C</i>	<i>D</i>
1.	32256	45045	20721	87000
2.	90463	91007	607073	420015
3.	230467	500607	728300	500006
4.	1783459	28738457	20503007	200719000
5.	70070220	700702202	770077077	6076076

Express by figures :

1. Thirteen thousand, two hundred forty.
2. Three hundred thousand, eight hundred seven.
3. Fifteen thousand, six hundred seventy-six.
4. Nine hundred eight thousand, two hundred six.
5. Eight hundred seventy-three thousand, nine.
6. Four million, three hundred eight thousand, fifty-six.

7. Forty-five million, four hundred five thousand, four hundred forty.

8. Eighty thousand, eight hundred eight.

ROMAN NOTATION

The Roman notation uses seven letters combined in different ways to represent numbers.

These are :

I	V	X	L	C	D	M
1	5	10	50	100	500	1000

Examples :

2 = II	12 = XII	9 = IX
14 = XIV	37 = XXXVII	44 = XLIV
84 = LXXXIV	97 = XCVII	1900 = <u>MCM</u>

EXERCISE

Write in Roman notation :

1. 444	999	748	4. 1919	1607	539
2. 73	66	119	✓ 5. 1794	1497	1983
3. 1800	1896	1910			

Write in figures :

6. MCIX	MCXXIX	CMXC
7. CMXCIV	DLIV	MIX
8. CDLXIII	DCXLIX	MMDC
9. MDXLIV	MCDX	MCMXCV
10. MCMIX	MDCVII	MCDXCII

The Simple Rules

ADDITION

Example: Add :

7458
 395
 4867
 3065
 4276
 563
 98
 4263
 759
8237
 61
 62
 33
 30
33981

The following method of addition is frequently used by commercial houses :

Under each column put down the sum without carrying.

This will enable you to check each addition column.

Add each column in reverse order.

Then add the sums of all the columns, and the result will be the sum of the numbers to be added.

EXERCISE

Add the following, and check the result :

1	2	3	4
380457	296783	568397	425839
27856	78564	283476	48376
179608	836584	57839	491978
435674	36478	276989	729536
62893	596597	954678	874390
297578	42693	365783	28375
3654	506470	29756	562938
82697	28967	473579	728957
7598	834056	80469	260583
728396	7839	705435	4895
<u>42657</u>	<u>42837</u>	<u>24683</u>	<u>65834</u>

5	6	7	8
748596	897368	29658	703085
589677	89658	477839	29873
768497	757346	28605	265839
69895	875970	984873	26576
2327	98773	26589	465983
787809	767658	739659	26717
73843	29394	82959	749385
296959	454573	477637	29575
668492	386497	26566	176589
97898	28756	738399	29639
287639	748393	20056	298347
<u>54038</u>	<u>29756</u>	<u>473793</u>	<u>947089</u>

9. A man in beginning farming made the following outlay: cost of 320 acres of land at \$27.00 per acre; horses 4 teams at \$385.00 per team; 6 cows at \$89.00 each; 27 one-year-old steers at \$43.00 each; 9 hogs at \$17.00 each; machinery, \$1,895.00; drilling a well, \$235.00. Find his total outlay.

10. The following shipments of grain were made from Fort William and Port Arthur for the crop year ending August 31st, 1918:

GRAIN	BY RAIL	BY VESSEL	TOTAL
	<i>Bush.</i>	<i>Bush.</i>	<i>Bush.</i>
Wheat	17,408,487	99,753,979	
Oats	11,508,066	18,002,124	
Barley	1,690,737	5,108,398	
Flaxseed	906,909	3,261,534	
Rye	139,415	63,586	
Totals			

Find the total amount of grain shipped: (1) by rail; (2) by vessel; (3) altogether.

11. In 1918 the railway mileage in Canada according to provinces was as follows :

Ontario	11,049 miles
Quebec	4,734 miles
Manitoba	4,194 miles
Saskatchewan	6,124 miles
Alberta	4,444 miles
British Columbia	3,885 miles
New Brunswick	1,959 miles
Nova Scotia	1,422 miles
Prince Edward Island	278 miles
Yukon	103 miles

Find the total mileage of railways in Canada.

12. The freight handled by the Canadian Railways in 1917 was as follows :

PRODUCTS	TONS HAULED
Products of Agriculture	25,127,454
Products of Animals	3,980,887
Products of Mines	42,534,637
Products of Forests	19,090,782
Manufactures	21,921,307
Merchandise	6,070,858
Miscellaneous	3,151,203

Find the total amount of freight hauled.

13. The production of coal in the different provinces in Canada during the year 1917 was as follows :

PROVINCE	TONS
Nova Scotia	6,324,684
New Brunswick	188,660
Saskatchewan	355,304
Alberta	4,723,139
British Columbia	2,418,929
Yukon Territory	4,872

Find the total amount of coal produced in Canada.

14. Write down the following statement of cash receipts. Add the amounts vertically and horizontally, and prove the correctness of your work by adding your totals.

	MON.	TUES.	WED.	THURS.	FRI.	SAT.	TOTAL.
1st . . .	\$89.37	\$75.68	\$57.47	\$193.85	\$57.36	\$142.79	
2nd . . .	75.39	65.43	83.29	81.09	74.23	136.95	
3rd . . .	84.96	47.62	95.54	86.57	128.47	95.86	
4th . . .	112.73	54.98	76.46	64.98	96.05	78.59	
5th . . .	75.86	49.17	49.89	72.36	85.73	83.69	
6th . . .	143.78	65.85	89.27	153.88	49.59	98.74	
Totals . .							

15. The following is a statement of the deposits made in one week at one branch of The Canadian Bank of Commerce. Find the total deposits for the week.

MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY.
\$539 42	\$384 75	\$865 73	\$834 72	\$565 25	\$986 38
1896 57	946 79	2653 76	365 36	793 65	765 65
265 39	385 76	764 89	2643 79	2638 17	839 25
9378 75	2965 78	829 63	856 35	598 95	743 16
468 39	643 64	3506 75	7269 75	1836 37	298 37
2654 36	5398 15	295 83	836 33	429 65	659 39
728 39	284 73	7653 27	428 57	843 79	794 79
4563 84	7659 83	643 75	6583 42	656 37	836 65
769 83	296 59	2983 43	928 67	959 83	795 89
2954 65	865 43	698 36	7265 38	2657 79	264 75
7647 83	2906 75	8465 78	865 49	989 35	695 83

Check the result by adding vertically and horizontally, and by adding the totals.

16. The acres and yields of field crops in Canada in 1917 were as follows :

FIELD CROP	AREA IN ACRES	YIELD IN BUSHELS
Wheat, Fall	906,000	20,753,000
Wheat, Spring	10,281,000	193,984,000
Oats	10,186,000	359,064,000
Barley	1,700,000	45,781,000
Rye	128,000	2,380,000
Peas	268,000	4,496,000
Beans	527,000	947,000
Buckwheat	352,000	8,017,000
Flaxseed	844,000	9,012,000
Mixed Grains	493,000	16,127,000
Potatoes	501,000	75,237,000
Total		

Find the total number of acres under crop, and the total number of bushels produced.

17. The number of pupils in the schools of Canada in 1917 was as follows :

PROVINCE	BOYS	GIRLS	TOTAL
Prince Edward Island	9,291	8,899	
Nova Scotia	53,560	55,472	
New Brunswick	32,025	32,751	
Quebec	122,338	130,399	
Ontario	266,255	261,409	
Manitoba	55,654	51,934	
Saskatchewan	71,246	67,485	
Alberta	54,446	53,281	
British Columbia	30,406	29,871	
Total			

Find: (1) the number of boys in school in Canada ; (2) the number of girls in school in Canada ; (3) the number of pupils in school in Canada.

SUBTRACTION

Example: Subtract, and check your result.

From 3407 take 2938.

3407

2938

469

Check $2938 + 469 = 3407$

EXERCISE

Subtract, and check your result in each of the following :

	A	B	C	D
1.	9438 <u>2759</u>	36406 <u>27658</u>	826003 <u>475639</u>	72000 <u>65839</u>
2.	731065 <u>467289</u>	960583 <u>750786</u>	940326 <u>738747</u>	8600034 <u>7269538</u>
3.	\$568.72 <u>298.95</u>	\$1306.15 <u>965.78</u>	\$7350.35 <u>2985.67</u>	\$8394.02 <u>965.75</u>
4.	\$8395.15 <u>2607.79</u>	\$6500.00 <u>2835.75</u>	\$3795.00 <u>2643.65</u>	\$2908.00 <u>1497.68</u>

5 A poultry farmer sold \$4569.44 worth of eggs and \$1416.45 worth of poultry in one year. His expenses for the year were as follows :

Labor \$145.00 per month for 12 months
 Feed \$135.00 per month for 12 months
 Marketing fowl . \$585.75

Find his net gain on the year's business.

6. The total number of dairy cattle in Canada in 1917 was 4,718,657. Of these, Ontario had 1,082,119; Quebec, 911,023; Nova Scotia, 131,442; Prince Edward Island, 46,032, and New Brunswick, 100,221. The remainder were in the four Western Provinces. Find the number of dairy cattle in the Western Provinces.

MULTIPLICATION AND DIVISION

Introductory.

The number by which we multiply another number is called the *multiplier*.

The number that is multiplied is called the *multiplicand*.

The result obtained by multiplying a number by another is called a *product*.

The multiplicand and multiplier are known as *factors of the product*.

A number used without reference to any particular thing or measure is called an *abstract number*; as 3, 8, 19.

A number used with reference to some particular thing or measure is called a *concrete number*; as 6 dollars, 2 inches, 4 boys, 7 boxes.

To check the accuracy of multiplication, divide the product by the multiplier. The quotient obtained should be the multiplicand.

Example:

$$239 \times 47$$

239	Multiplicand
47	Multiplier
<u>1673</u>	
<u>956</u>	
<u>11233</u>	Product

Check
239
47 <u>11233</u>
<u>94</u>
<u>183</u>
<u>141</u>
<u>423</u>
<u>423</u>

$$\$38.25 \times 36$$

\$38.25
<u>36</u>
22950
<u>11475</u>
\$1377.00

If the multiplicand is a concrete number, the product will be a concrete number of the same kind.

The *dividend* is the number divided.

The *divisor* is the number by which the dividend is divided.

The result of the division is the quotient.

The part of the dividend that is left when the division is not exact is called the *remainder*.

To check the accuracy of division, multiply the quotient by the divisor and add the remainder. The result should be the dividend.

Example: 1. $86523 \div 327$.

86523	Dividend,	327	Divisor.	Check
264	Quotient			264 Quotient
327 $\overline{)86523}$				327 Divisor
654				1848
2112				528
1962				792
1503				86328
1308				195
195	Remainder			86523
				Remainder
				Dividend

2. $\$473.25 \div 35$.

\$13.52	
35 $\overline{)\$473.25}$	
35	
123	
105	
182	
175	
75	
70	
5	Remainder

If the dividend is a concrete number and the divisor is an abstract number, the quotient will be a concrete number of the same kind as the dividend.

3. $864354 \text{ pecks} \div 3 \text{ pecks.}$

$$\begin{array}{r} 288118 \\ 3 \text{ pecks} \overline{)864354} \text{ pecks.} \end{array}$$

If the dividend and the divisor are concrete numbers of the same kind, the quotient will be an abstract number.

NOTE TO THE TEACHER.— Review carefully the multiplication tables, giving oral work also on the division processes.

For example:

How many 8's are in 40, 68, 36, 54, etc.?

How many 7's are in 14, 24, 35, 58, etc.?

EXERCISE

Multiply, and check your answers:

<i>A</i>	<i>B</i>
1. 2349×78	7365×39
2. 50637×37	64097×89
3. 45396×136	784509×178
4. 506308×53	780964×49
5. 76403×507	86427×809
6. 567983×490	836407×730
7. 400068×329	670050×473
8. 564836×726	896537×495
9. 260934×379	546036×786
10. 26975×734	240653×831

Multiply, and check your answers:

11. $\$526.45 \times 38$	$\$728.38 \times 47$
12. $\$983.03 \times 239$	$\$364.95 \times 278$

Divide, and check your answers:

13. $426530 \div 36$	$764803 \div 49$
14. $628395 \div 53$	$846576 \div 78$

<i>A</i>	<i>B</i>
15. $139847 \div 123$	$2836546 \div 189$
16. $6740384 \div 238$	$7648308 \div 369$
17. $129704 \div 352$	$6023080 \div 479$
18. $3658407 \div 783$	$724680 \div 598$
19. $756874 \div 767$	$1670009 \div 695$
20. $1450112 \div 872$	$2730413 \div 437$

Divide, and check your answers :

- | | |
|---|--|
| 21. $\$2018.35 \div 39$ | $\$56283.39 \div 78$ |
| 22. $\$23463.75 \div 129$ | $\$43078.65 \div 237$ |
| 23. $\$506.38 \div 23$ | $\$7298.45 \div 39$ |
| 24. $58648 \text{ rods} \div 238 \text{ rods}$ | $76483 \text{ tons} \div 179 \text{ tons}$ |
| 25. $628947 \text{ sq. yds.} \div 239 \text{ sq. yds.}$ | |

EXERCISE

Find how many of the following you can work in 10 minutes. Multiply separately :

1. $465,873$; $529,837$; $693,485$; $\times 378$
2. $725,368$; $943,582$; $463,278$; $\times 469$
3. $329,567$; $234,789$; $876,359$; $\times 583$
4. $465,723$; $654,678$; $283,596$; $\times 763$
5. $347,598$; $268,479$; $537,486$; $\times 297$
6. Divide each of the above numbers by 329.
7. Divide each of the above numbers by 573.
8. Divide each of the above numbers by 483.
9. Divide each of the above numbers by 867.
10. Divide each of the above numbers by 749.

EXERCISE

1. The wheat production in the Prairie Provinces for 1917 was as follows :

Manitoba	41,039,700 bushels
Saskatchewan	117,921,300 bushels
Alberta	52,992,100 bushels

If the average price per bushel was \$1.87, what was the value of the wheat crop, (1) for each of the provinces ; (2) for the three provinces.

2. For every \$100.00 borrowed, the Dominion of Canada pays interest at the rate of \$5.50 per year. What will be the yearly interest on Canada's Victory Loan of \$350,000,000 ?

3. In 1917 Manitoba, Saskatchewan, Alberta, and British Columbia produced 17,348,844 lbs. of butter which was sold at an average price of 38 cents per lb. What was the total value of the butter production for the year ?

4. A rancher shipped 4 carloads of stock to the Winnipeg Stockyards. Each car averaged 25 head. The cattle were sold at \$9.00 per cwt., and the total weight of the shipment was 115,700 lbs. What was the average price received per head ?

5. A coal dealer bought at the mines 450 tons of coal at \$7.25 per ton. The freight charges were 95 cents per ton, and the cost of handling was 75 cents per ton. How much would the dealer gain, if he sold the coal for \$9.65 per ton ?

6. A sheep man bought 225 sheep at \$11.00 each and 350 sheep at \$13.00 each. He sold the wool so that he received for it an average price of \$4.25 per sheep. He sold all the sheep for \$12.00 each. How much did he gain on this transaction ?

7. A farmer sowed 160 acres of wheat. It cost him \$6.00 per acre to prepare the ground for seed. He sowed $1\frac{1}{2}$ bushels to the acre, the seed costing him \$2.20 per bushel. It cost him \$3 per acre to harvest the crop and 6 cents per bushel for threshing. He sold the crop, which averaged 35 bushels per acre, at \$1.85 per bushel.

Find the following :

- (1) What the crop cost him to raise.
- (2) What he sold the entire crop for.
- (3) His profit from the sale of the crop.
- (4) How much he made on each acre of land.

8. In 1916 there were in Alberta and Saskatchewan 599,509 dairy cattle valued at \$31,624,099.75. Find the average value per head.

9. In 1917 there were in Manitoba and Saskatchewan 556,580 milch cows valued at \$86.75 per head. What was the total value of these cows?

10. The average yield of potatoes in Canada in 1915 with the price per bushel was as follows :

PROVINCE	YIELD PER ACRE	PRICE PER BUSHEL
Ontario	93 bush.	76 cents
Quebec	149 bush.	55 cents
Nova Scotia	141 bush.	58 cents
Prince Edward Island	114 bush.	46 cents
New Brunswick	144 bush.	64 cents
Manitoba	86 bush.	64 cents
Saskatchewan	110 bush.	68 cents
Alberta	142 bush.	44 cents
British Columbia	247 bush.	45 cents

Find the following :

- (1) The value per acre of potatoes in each of the provinces.
- (2) The average yield per acre for Canada.
- (3) The average price per bushel for Canada.
- (4) The average price return per acre for Canada.

DENOMINATE NUMBERS

Long Measure, or Measure of Length and Distance

TABLE

12 inches (in.)	= 1 foot (ft.)
3 feet	= 1 yard (yd.)
$5\frac{1}{2}$ yards	= 1 rod (rd.)
320 rods	= 1 mile (mi.)
1760 yards	= 1 mile
5280 feet	= 1 mile
<i>63,360 in.</i>	<i>= 1 mile</i>

REVIEW EXERCISE

1. Reduce 18 rods 4 yards 2 feet to feet.
2. Reduce 52 yards 2 feet 9 inches to inches.
3. Reduce 4 miles 180 rods 4 yards to yards.
4. Reduce 6248 inches to yards, feet, and inches.
5. Reduce 4578 feet to rods, yards, and feet.
6. Reduce 36,578 yards to miles and yards.
7. Reduce 29,800 feet to miles and feet.
8. A merchant in taking stock of the cotton in his store finds he has 4 pieces containing the following lengths: 48 yards 2 feet 9 inches, 56 yards 10 inches, 74 yards 2 feet 8 inches, and 18 yards 2 feet. How much cotton has he in stock?

9. What is the total width in feet and inches of 2 doors each 54 inches wide and 5 windows each 38 inches wide?

10. A man walks $1\frac{1}{2}$ miles. If each step is 30 inches in length, how many steps does he take in his walk?

11. A piece of land has a frontage of 120 rods on a street. Into how many lots with a frontage of 30 feet each can this land be subdivided?

12. Telephone poles are placed 8 rods apart. How many poles will be required for a telephone line 15 miles long?

Square Measure, or Measure of Area and Surface

TABLE

144 square inches (sq. in.)	= 1 square foot (sq. ft.)
9 square feet	= 1 square yard (sq. yd.)
$30\frac{1}{4}$ square yards	= 1 square rod (sq. rd.)
160 square rods	= 1 acre (ac.)
640 acres	= 1 square mile (sq. mi.)
160 acres	= $\frac{1}{4}$ section of land
320 acres	= $\frac{1}{2}$ section of land
640 acres	= 1 section of land
36 sections	= 1 township

TOWNSHIP

31	32	33	34	35	36
30	29	28	27	26	25
19	20	21	22	23	24
18	17	16	15	14	13
7	8	9	10	11	12
6	5	4	3	2	1

SECTION

160 acres
320 acres

REVIEW EXERCISE

1. Reduce 36 acres 80 square rods to square rods.
2. Reduce 4 square rods 6 square yards to square feet.
3. Reduce 3 square yards 26 square feet 96 square inches to square inches.
4. Reduce 4800 square rods to acres.
5. Reduce 16,500 acres to square miles and acres.
6. How many quarter sections are there in 6 square miles?
7. A school district contains 18 sections of land. How many acres does it contain?
8. I have 500 sheets of paper, each sheet measuring 36 inches by 24 inches. How many smaller sheets 6 inches by 4 inches can be cut from the 500 sheets?
9. How many square yards of linoleum are required to cover the floor of a room 15 feet long and 12 feet wide? What is the cost of the linoleum at \$1.50 per square yard?
10. A field is 40 rods wide and contains 20 acres. What is its length?

Surveyor's Measure

TABLE

100 links or 4 rods	= 1 chain
80 chains or 5280 feet	= 1 mile
16 square rods	= 1 square chain
10 square chains	= 1 acre

EXERCISE

Find the areas of the following fields in acres :

1. A field 16 chains long and 12 chains wide.
2. A field 23 chains long and 14 chains wide.

3. A field 36 chains long and 18 chains wide.
4. A field 40 chains by 25 chains.
5. A field 24 chains 2 rods long and 12 chains wide.
6. A field 36 chains 2 rods long and 12 chains 2 rods wide.
7. A field 15 chains 20 links long and 12 chains wide.
8. A field 24 chains 50 links long and 16 chains 25 links wide.

Cubic Measure, or Measure of Volume

TABLE

1728 cubic inches (cu. in.)	= 1 cubic foot (cu. ft.)
27 cubic feet	= 1 cubic yard (cu. yd.)
128 cubic feet	= 1 cord (cd.)

1 cubic foot of water contains $6\frac{1}{4}$ gallons (approximately.)

1 cubic foot of water weighs 1000 ounces, or $62\frac{1}{2}$ pounds (approximately).

REVIEW EXERCISE

1. Reduce 5 cubic feet 85 cubic inches to cubic inches.
2. Reduce 28 cubic yards 15 cubic feet to cubic feet.
3. Reduce 3 cords 96 cubic feet to cubic feet.
4. Reduce 56,780 cubic inches to cubic feet and cubic inches.
5. Reduce 576 cubic feet to cubic yards and cubic feet.
6. Reduce 6400 cubic feet to cords.
7. A reservoir is 12 feet long, 10 feet wide, and 6 feet deep. How many gallons of water does it hold?

8. If 1 load of earth contains 27 cubic feet, find the number of loads of earth removed in excavating a cellar 28 feet long, 27 feet wide, and 7 feet deep.

9. How many cords of wood are in a pile 8 feet long, 6 feet high, and 4 feet wide? Find the cost of the wood at \$5.60 per cord.

10. A tank filled with water is 8 feet long, 4 feet wide, and 3 feet deep. What is the weight of the water in the tank?

Dry and Liquid Measures

TABLE

Dry Measure	Liquid Measure
2 pints = 1 quart	2 pints = 1 quart
8 quarts = 1 peck	4 quarts = 1 gallon
4 pecks = 1 bushel	8 pints = 1 gallon
1 bushel contains $1\frac{1}{2}$ cubic feet (approximately).	
1 gallon contains $277\frac{1}{4}$ cubic inches (approximately).	

REVIEW EXERCISES

1. Reduce 5 gallons 3 quarts to pints.
2. Reduce 24 bushels 3 pecks 1 gallon to gallons.
3. Reduce 257 pints to gallons, quarts, and pints.
4. Reduce 640 quarts to bushels.
5. Reduce 475 pints to pecks, quarts, and pints.
6. A milk dealer buys 36 gallons of milk. How many quart-bottles of milk can he fill from this?
7. A milk dealer buys milk at \$3.60 per 10 gallons and sells it at 15 cents per quart. If he sells 240 gallons of milk in a day, how much money per day does he make above the cost of the milk?

8. How many gallons of fresh water should a ship carry that has on board 1500 people for a voyage of 12 days, if 3 quarts per day are allowed for each person?

9. A gardener sold 3 quarts of green beans to each of 48 customers and 6 quarts of green peas to each of 36 customers. The price of the beans was 75 cents per peck, and the peas were sold at 10 cents per pint. How much did he receive from the sales?

10. A man fed $1\frac{1}{2}$ gallons of oats per day to each of his horses during the spring season of 12 weeks. If he had 8 teams working, how many bushels of oats did he feed? What was the cost of the oats at 78 cents per bushel?

Avoirdupois Weight

TABLE

16 ounces	= 1 pound	(lb.)
100 pounds	= 1 hundredweight	(cwt.)
2000 pounds	= 1 ton	(T.)
20 hundredweight	= 1 ton	

REVIEW EXERCISE

1. Reduce 42 oz. to lbs. and oz.
2. Reduce 5 tons 75 cwt. to lbs.
3. Reduce 6578 lbs. to tons, cwt., and lbs.
4. A barn is 48 feet long, 32 feet wide, and 14 feet high. Allowing 6 lbs. of hay to each cubic foot, estimate how many tons of hay can be stored in the barn.
5. If 1 cubic foot of water weighs 1000 ounces, find the weight in tons and cwt. of water 4 inches deep covering 25 acres of land.

6. A coal dealer bought 3 car loads of coal at \$3.75 per ton. The loads weighed 64,800 lbs., 72,450 lbs., and 81,550 lbs. Find the cost of the coal.

7. A woman marketed her fowl, being paid the following prices: turkeys 32 cents per lb.; chickens 26 cents per lb.; geese 28 cents per lb. She sold 27 turkeys averaging in weight 19 lbs. 8 oz.; 48 chickens averaging in weight 6 lbs. 7 oz.; 16 geese averaging in weight 11 lbs. 3 oz. How much did she receive for the poultry?

8. A man sold 25 head of cattle, which averaged in weight 1320 lbs., at \$8.75 per cwt. How much did he receive for the cattle?

Table of Miscellaneous Weights

The following table gives the weight of a bushel of the articles named:

Wheat	60 lbs.	Corn	56 lbs.
Oats	34 lbs.	Beans	60 lbs.
Barley	48 lbs.	Peas	64 lbs.
Rye	56 lbs.	Carrots	50 lbs.
Potatoes	60 lbs.	Parsnips	45 lbs.
Timothy seed . .	48 lbs.	Beets	50 lbs.
Flax seed . . .	56 lbs.	Turnips	50 lbs.
Clover seed . . .	60 lbs.	Onions	50 lbs.
196 lbs. flour = 1 barrel.		200 lbs. pork = 1 barrel.	
100 lbs. nails = 1 keg.			

REVIEW EXERCISE

1. A farmer sold 6 loads of wheat, the average weight of each load being 1740 lbs., at \$1.78 per bushel. How much did he receive for the wheat?

2. I sold 15 loads of oats, the average weight of which was 1598 lbs., at 69 cents per bushel. How much did I receive for the oats?

3. A gardener raised the following crops on separate plots: 4 acres potatoes, 28,080 lbs.; 2 acres turnips, 14,760 lbs.; 3 acres beans, 17,640 lbs. Find the average yield of each in bushels per acre.

4. Find the total cost of the following farm products:

2640 lbs. of wheat at \$2.15 per bushel.

2210 lbs. oats at 67 cents per bushel.

3600 lbs. barley at 98 cents per bushel.

5280 lbs. of potatoes at \$1.35 per bushel.

5. An elevator holds 2,500,000 bushels of wheat. Find in tons the capacity of the elevator.

Time Measure

TABLE

60 seconds (sec.) = 1 minute (min.)	January	31 days
60 minutes = 1 hour (hr.)	February	28 days
24 hours = 1 day (da.)	March	31 days
7 days = 1 week (wk.)	April	30 days
365 days = 1 year (yr.)	May	31 days
366 days = 1 leap year	June	30 days
52 weeks = 1 year	July	31 days
	August	31 days
	September	30 days
	October	31 days
<i>Note.</i> In leap year February has	November	30 days
29 days.	December	31 days

REVIEW EXERCISE

1. A man borrowed money on April 5th and paid it back on September 18th. How many days did he have the money?

2. Find the number of days between March 21st and November 24th.

3. A man works 44 hours per week during a season of 28 weeks. How many hours does he work altogether? If he earns 65 cents per hour, find his wages for the season.

4. Find the number of days between Dec. 17th, 1915 and March 20th, 1916.

5. A train leaves Lethbridge at 4.35 P.M. and arrives at Calgary at 10.15 P.M. Find the time in hours and minutes it takes to make the journey.

6. A train leaves Winnipeg at 10.00 P.M. Tuesday and arrives at Calgary at 2.45 A.M. Thursday. How many hours and minutes does it take to make the trip?

MISCELLANEOUS TABLE

12 units or things	= 1 dozen
12 dozen	= 1 gross
12 gross	= 1 great gross
20 units or things	= 1 score
24 sheets of paper	= 1 quire
20 quires	= 1 ream

REVIEW EXERCISE

1. How many quires are in 48 sheets? 144 sheets? 216 sheets?

2. How many pencils are in a shipment containing 15 gross?

3. A man shipped each day for 15 days a case of eggs containing 24 dozen. How many eggs did he ship?

4. Oranges are sold at 60 cents per dozen. How many should I get for 25 cents?

5. Bananas are sold at 2 for 15 cents. What is the price of 3 dozen?

6. I bought 5 reams of paper at \$2.50 per 500 sheets. How much did I pay for the paper?

7. A dealer buys lead pencils at \$6.50 per gross and sells them at 10 cents each. How much does he make on each gross of pencils?

8. Find the cost of 80 dozen pen holders at \$4.80 per gross.

COMPOUND RULES

Addition of Compound Denominate Numbers

Simple Number

Denominate Number

423

4 hundreds 2 tens 3 units 4 bushels 2 pecks 3 gallons

In simple numbers ten units of each order always make one unit of the next order, while in compound denominate numbers the number of units of a lower denomination required to make one unit of the next higher order varies with the denomination we are using.

HUNDREDS	TENS	UNITS	
5	2	6	
3	1	4	21 hundreds 9 tens 27 units =
7	2	8	22 hundreds 1 ten 7 units =
6	4	9	2217.
<u>21</u> hundreds	<u>9</u> tens	<u>27</u> units	

YARDS	FEET	INCHES	
5	2	6	
3	1	4	27 in. = 2 ft. + 3 in.
7	2	8	9 ft. + 2 ft. = 11 ft. = 3 yd. + 2 ft.
6	4	9	21 yd. + 3 yd. = 24 yd.
<u>21</u> yards	<u>9</u> feet	<u>27</u> inches	21 yd. 9 ft. 27 in. = 24 yd. 2 ft. 3 in.

EXPLANATION. — The like units are written in columns. The sum of the inches is 27 in., or 2 ft. 3 in. Write the 3 in. under the inches column and add the 2 ft. to the feet column. The sum of the feet column is 11 ft. or 3 yd. 2 ft. Write the 2 ft. under the feet column and add the 3 yd. to the yards column. The sum of the yards column is 24 yd. Hence the sum is 24 yd. 2 ft. 3 in.

EXERCISE

Add :

$$\begin{array}{r} 1. \quad 5 \text{ lbs.} \quad 9 \text{ oz.} \\ \quad 3 \quad \quad 8 \\ \quad 6 \quad \quad 12 \\ \hline \end{array}$$

$$\begin{array}{r} 2. \quad 2 \text{ bu.} \quad 2 \text{ pk.} \quad 4 \text{ qt.} \\ \quad 6 \quad \quad 3 \quad \quad 6 \\ \quad 8 \quad \quad 1 \quad \quad 5 \\ \hline \end{array}$$

$$\begin{array}{r} 3. \quad 20 \text{ cwt.} \quad 87 \text{ lbs.} \quad 11 \text{ oz.} \\ \quad 16 \quad \quad 12 \quad \quad 66 \\ \quad 19 \quad \quad 43 \quad \quad 13 \\ \hline \end{array}$$

$$\begin{array}{r} 4. \quad 8 \text{ hr.} \quad 15 \text{ min.} \quad 28 \text{ sec.} \\ \quad 3 \quad \quad 20 \quad \quad 12 \\ \quad 6 \quad \quad 27 \quad \quad 30 \\ \quad 9 \quad \quad 30 \quad \quad 42 \\ \hline \end{array}$$

$$\begin{array}{r} 5. \quad 10 \text{ bu.} \quad 1 \text{ pk.} \quad 1 \text{ qt.} \quad 1 \text{ pt.} \\ \quad 2 \quad \quad 3 \quad \quad 6 \quad \quad 0 \\ \quad 5 \quad \quad 2 \quad \quad 3 \quad \quad 1 \\ \quad 8 \quad \quad 3 \quad \quad 1 \quad \quad 1 \\ \quad 15 \quad \quad 2 \quad \quad 4 \quad \quad 0 \\ \hline \end{array}$$

$$\begin{array}{r} 6. \quad 4 \text{ yd.} \quad 1 \text{ ft.} \quad 9 \text{ in.} \\ \quad 5 \quad \quad 2 \quad \quad 2 \\ \quad 3 \quad \quad 2 \quad \quad 7 \\ \quad 0 \quad \quad 2 \quad \quad 10 \\ \quad 1 \quad \quad 1 \quad \quad 11 \\ \hline \end{array}$$

7. Find the sum of : 1 wk. 2 da. 13 hr. 40 min. 30 sec ; 2 wk. 6 da. 10 hr. 8 min. 3 sec. ; 5 da. 22 hr. 55 min. 45 sec. ; 4 hr. 1 min. 15 sec. ; 1 wk. 2 da. 4 hr. 5 min.

8. The lengths of the blackboards in a schoolroom are 4 yd. 1 ft. 8 in., 3 yd. 9 in., and 3 yd. 2 ft. 5 in. Find the total length of the three boards.

9. A man walked 17 mi. 360 yd. on Monday ; 21 mi. 840 yd. on Tuesday ; 18 mi. 748 yd. on Wednesday ; 16 mi. 1289 yd. on Thursday ; 20 mi. 196 yd. on Friday ; and 7 mi. 1348 yd. on Saturday. How far did he walk during the week?

3. One board is 15 ft. long; another is 12 ft. 10 in. long. What is the difference in the lengths of these boards?

4. A rectangular room is 8 yd. 1 ft. long and 5 yd. 2 ft. wide. By how much does its length exceed its width?

5. Subtract :

(a) 7 mi. 1 yd. 1 ft. 3 in.

1 1 2 7

(b) 69 A. 10 sq. yd. 3 sq. ft.

10 15 7

6. A farmer had 200 bu. of wheat and sold 28 bu. 2 pk. to one man, and the same quantity to another. How much wheat has he left?

7. From a barrel of water containing 54 gallons, a person took 12 gal. 3 qt. on one day, and 9 gal. 2 qt. 1 pt. on another day. How much was left?

8. From 29 sq. yd. 128 sq. in. subtract 16 sq. yd. 5 sq. ft. 140 sq. in.

9. A grocer has 1 cwt. 18 lbs. of sugar in one barrel 96 lbs. in another, and 1 cwt. 61 lbs. in a third. After selling 1 cwt. 90 lbs., how much sugar will he have left?

10. A bicycle rider has a journey of 300 mi. to go. The first day he rides 75 mi. 48 rd.; the next, 83 mi. 175 rd.; the next, 68 mi. 163 rd. How far has he yet to ride?

EXERCISE

1. How much must be added to 5 A. 785 sq. yd. 5 sq. ft. to make 10 A.?

2. A speaker began a speech at 9 hr. 28 min. 40 sec. after noon and ended 11 hr. 4 min. 25 sec. after noon. How long did he speak?

3. The angles of a triangle contain 180° . One angle measures $36^\circ 14' 56''$ and another $80^\circ 56'$. Find the third angle.

4. From a 12-acre field four lots were sold. The first contained 2400 sq. yd., the second 3216 sq. yd., the third 2525 sq. yd., and the fourth 2845 sq. yd. What part of the field remained unsold?

5. A farmer came to town with 25 bu. of potatoes. He sold 5 bu. 1 pk. 1 gal. to one man, 6 bu. 3 pk. to a second, 7 bu. 1 gal. to a third, and 4 bu. 1 pk. 1 gal. to a fourth. What quantity had he left?

6. A man bought 10 T. of coal, but his bin held only five loads. The first load received weighed 1984 lbs., the second 1 T. 112 lbs., the third 1 T. 247 lbs., the fourth 1 T. 356 lbs., and the fifth 1978 lbs. How much coal has he yet to receive?

7. From 25 yd. of ribbon a storekeeper sold to one customer 3 yd. 1 ft. 6 in., to another 5 yd. 2 ft. 3 in., and to a third 7 yd. How many yards remained?

8. A wood dealer had 125 cd. of wood. He sold 7 loads. The first measured 1 cd. 112 cu. ft., the second 1 cd. 60 cu. ft., the third 1 cd. 75 cu. ft., the fourth 1 cd. 15 cu. ft., the fifth 1 cd. 95 cu. ft., the sixth 1 cd. 108 cu. ft., and the seventh 1 cd. 36 cu. ft. How much wood had he left?

9. A cistern is full and holds 1250 gal. of water. 120 cu. ft. are drawn out. How many gallons remain in the cistern?

10. A rode 400 mi. on his bicycle in six days. On Monday he rode 50 mi. 1250 yd. 2 ft. 6 in.; on Tuesday, 55 mi. 1 ft. 9 in.; on Wednesday, 60 mi. 360 yd. 9 in.; on Thursday, 72 mi. 1450 yd.; on Friday, 63 mi. 1375 yd. 1 ft. 6 in. How far did he ride on Saturday?

Compound Multiplication

Multiply 3 yd. 2 ft. 7 in. by 9.

3 yd.	2 ft.	7 in.	3 yd.	2 ft.	7 in.
		9			9
27 yd.	18 ft.	63 in.	34 yd.	2 ft.	3 in.

EXPLANATION. — 9 times 7 in. = 63 in. = 5 ft. 3 in.

Write the 3 in. under the denomination inch and add the 5 ft. to the product, 9 times 2 ft.

$$9 \text{ times } 2 \text{ ft.} = 18 \text{ ft.}$$

$$18 \text{ ft.} + 5 \text{ ft.} = 23 \text{ ft.} = 7 \text{ yd. } 2 \text{ ft.}$$

Write the 2 ft. under the denomination feet and add the 7 yd. to the product, 9 times 3 yd.

$$9 \text{ times } 3 \text{ yd.} = 27 \text{ yd.}$$

$$27 \text{ yd.} + 7 \text{ yd.} = 34 \text{ yd.}$$

The entire product is, therefore, 34 yd. 2 ft. 3 in.

EXERCISE

1. Multiply 2 hr. 8 min. by 7; 2 ft. 3 in. by 3; 5 mi. 100 yd. by 7.

2. Multiply 4 lbs. 9 oz. by 6; 15 yd. 9 in. by 4; 10 yd. 18 in. by 2.

3. A watch gains 1 min. 17 sec. in a day. How much will it gain in a week?

4. The side of a square plot of ground is 30 yd. 2 ft. 8 in. Find the perimeter of the plot.

5. If a cubic foot of water weighs 62 lbs. 8 oz., what is the weight of the water in a tank that contains 42 cu. ft.?

6. A farmer has 250 acres to plow. He has had 4 teams plowing for 20 days. If each team plowed 2 A. 4 sq. rd. per day, how much remains to be plowed?

7. On a voyage a steamer sailed 15 mi. 680 yd. 2 ft. each hour. How far did the steamer sail in a voyage of two days?

8. The height of the first story in a city office building is 14 ft. 8 in., and the height of each story above the first is 10 ft. 9 in. If the building is an eight-story building, what is its height?

9. 4 bars of iron, each 4 ft. 5 in. long, are cut from a bar 20 ft. 6 in. long. What length of bar is left?

10. A commercial traveller motors 6 da. a week for 2 weeks. The first week he averages 6 gal. 2 qt. of gasoline per day, and the second week 8 gal. 3 qt. per day. How much gasoline does he use in the two weeks?

11. A farmer owns a cow that gives an average of 4 gal. 2 qt. of milk daily during the month of April. He sells the milk at 5¢ a quart. How much money does this cow earn for the farmer during the month?

Compound Division

Divide 18 in. by 6; 24 bu. by 8; 60 min. by 12. What kind of number is the divisor in each case? What kind of number is the quotient in each case?

Divide 18 in. by 6 in; 24 bu. by 8 bu.; 60 min. by 12 min. What kind of number is the divisor in each case? What kind of number is the quotient in each case?

Division of a Compound Number by an Abstract Number.

Divide 18 yd. 1 ft. 8 in. by 4.

$$\begin{array}{r} 4 \text{ yd. } 1 \text{ ft. } 11 \text{ in.} \\ 4 \overline{) 18 \text{ yd. } 1 \text{ ft. } 8 \text{ in.}} \end{array}$$

EXPLANATION. — Arrange as in ordinary division of simple numbers.
 $18 \text{ yd.} \div 4 = 4 \text{ yd.}$ with remainder 2 yd., or 6 ft.

$6 \text{ ft.} + 1 \text{ ft.} = 7 \text{ ft.}$ $7 \text{ ft.} \div 4 = 1 \text{ ft.}$ with remainder 3 ft., or 36 in.

$36 \text{ in.} + 8 \text{ in.} = 44 \text{ in.}$ $44 \text{ in.} \div 4 = 11 \text{ in.}$

The quotient is, therefore, 4 yd. 1 ft. 11 in.

Division of a Compound Number by another Compound Number.

Divide 20 yd. 12 in. by 3 yd. 14 in.

Reduce :

$$20 \text{ yd. } 12 \text{ in.} = 732 \text{ in.}$$

$$3 \text{ yd. } 14 \text{ in.} = 122 \text{ in.}$$

$$20 \text{ yd. } 12 \text{ in.} \div 3 \text{ yd. } 14 \text{ in.} = 732 \text{ in.} \div 122 \text{ in.} = 6.$$

EXERCISE

Divide :

1. 10 yd. 2 ft. by 8.
2. 5 mi. 240 rd. by 8.
3. 4 gal. 2 qt. by 3.
4. 112 T. 16 cwt. 66 lb. by 7.
5. 3 cu. yd. 3 cu. ft. by 6.

EXERCISE

Divide :

1. 11 ft. 9 in. by 3 ft. 11 in.
2. 20 yd. 12 in. by 3 yd. 14 in.
3. 697 lbs. 7 oz. by 60 lb. 10 oz.
4. 69 bu. 3 pk. 6 qt. by 6 bu. 3 pk. 6 qt.
5. 55 ft. 6 in. by 6 ft. 2 in.

EXERCISE

1. How many jars, each holding 2 gal. 3 qt. 1 pt., can be filled from a tank holding 71 gal. 3 qt. 1 pt.?
2. The perimeter of a square is 6 ft. 8 in. Find the length of one side.
3. A man walks at the rate of one mile in 19 min. How many miles will he walk in 1 hr. 54 min.?
4. A fruit grower has 84 bu. of apples to market in barrels. If each barrel holds 3 bu. 2 pk., how many barrels will it take?

5. A and B start from points 30 mi. 500 yd. apart to meet each other. A walks at the rate of 3 mi. 368 yd. per hr. and B at the rate of 3 mi. 555 yd. per hr. How far are they apart at the end of 4 hours?

6. If both sides of a railroad are fenced with wire purchased at 5¢ per rod, find the cost of fencing one mile of railroad, the fence being 5 wires high.

7. A train 440 ft. long runs past a post in 12 seconds. How many miles an hour is it travelling?

8. An ocean steamer burns coal at the rate of 1 T. 2 cwt. for every 25 miles. How many tons are required for a voyage of 3750 miles?

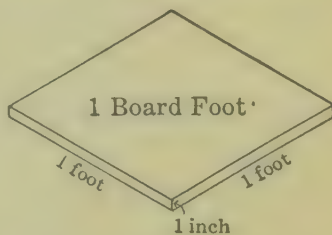
9. From a 40-acre field of alfalfa 3 crops were harvested in one year. The average yield per acre for each crop was 2750 lbs. What was the year's yield off this field worth at \$25 per ton?

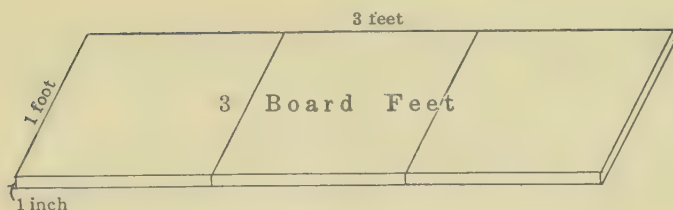
Lumber Measure

The unit of lumber measure is the *board foot*, which is a piece of board 1 foot long, 1 foot wide, and 1 inch or less in thickness.

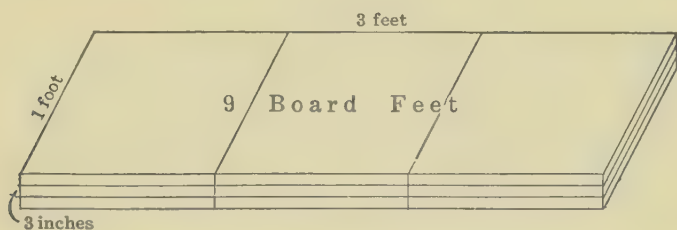
If a board is one inch or less in thickness, the number of board feet it contains is the number of square feet in one surface of the board.

Note. — Lumber less than one inch in thickness is reckoned as if it were an inch. If lumber is $1\frac{1}{2}$ " in thickness, the number of board feet is $1\frac{1}{2}$ times the number of square feet on one surface of the board. If the lumber is 2" in thickness, the number of board feet is 2 times the number of square feet on one surface of the board, etc.





A board 3 feet long, 1 foot wide, and 1 inch thick contains 3 board feet.



A board 3 feet long, 1 foot wide, and 3 inches thick would contain 9 board feet. That is, the number of board feet is three times the number of square feet on one side of the board.

A board 18 feet long, 6 inches wide, and 2 inches thick would contain $(18 \times \frac{1}{2}) \times 2$ board feet or 18 board feet.

A board 12 feet long, 4 inches wide, and 3 inches thick would contain $(12 \times \frac{1}{3}) \times 3$ board feet or 12 board feet.

Rule. — To find the number of board feet, multiply the number of feet in the length by the number of feet in the width by the number of inches in the thickness.

In making out a bill of lumber the number of pieces are entered first, followed by the thickness and width expressed in inches and the length in feet. In billing 7 pieces, 2 inches thick, 8 inches wide, and 16 feet long, the form would be :

7 pcs. 2'' $\times$ 8''—16' ('' is used to denote inches and ' is used to denote feet).

The price of lumber is generally quoted at so much per one thousand feet. The letter M is used to denote one thousand feet.

15 pieces of No. 1 fir, 2 inches thick, 6 inches wide, and 14 feet long at \$60.00 per thousand would appear in a bill in this form :

15 pcs. 2'' $\times$ 6''-14' #1 Fir @ \$60.00 per M.

EXERCISE

- Find the number of board feet in the following :
 - A board 12 ft. long, 12 in. wide, and 2 in. thick.
 - A board 16 ft. long, 9 in. wide, and 2 in. thick.
 - A board 18 ft. long, 4 in. wide, and 1 in. thick.
 - A board 14 ft. long, 6 in. wide, and 3 in. thick.
- How many feet, board measure, are in 12 planks, 16 ft. long, 9 in. wide, and 2 in. thick ?
- How many feet, board measure, are in 100 scantlings, 18 ft. long, 4 in. wide, and 4 in. thick ?
- How much inch lumber will be required to fence a rectangular lot 66 ft. wide by 120 ft. long with a close board fence 6 ft. high ?
- Find the number of feet, board measure, of lumber in

10 pcs. 2'' $\times$ 4''-12'	12 pcs. 4'' $\times$ 4''-18'
15 pcs. 3'' $\times$ 9''-16'	20 pcs. 2'' $\times$ 6''-14'
- How many feet of lumber are in a load containing 50 pieces 18 ft. long, 8 in. wide, and 3 in. thick and 100 pieces 16 ft. long, 9 in. wide, and 1 in. thick ?
- At \$40.00 per M find the cost of the following :

20 pcs. 1'' $\times$ 12''-15'	40 pcs. 4'' $\times$ 4''-15'
50 pcs. 2'' $\times$ 6''-12'	100 pcs. 3'' $\times$ 4''-18'
200 pcs. 2'' $\times$ 9''-16'	

8. At \$30 per M what will it cost to lay a floor in a shed 15 ft. wide and 20 ft. long with plank 2 in. thick?
9. How many feet of lumber will be required to floor a bridge 100 ft. long and 12 ft. wide with 3 in. plank?
10. Find the cost of 500 scantlings 18 ft. long, 4 in. wide, and 3 in. thick at \$35 per M.

Plastering, Painting, etc.

Plastering, painting, and kalsomining, etc., are usually measured by the square yard. There is no uniform custom as to deductions for openings and baseboard. Sometimes one-half the area of the doors and windows is allowed in estimating the cost of the labor. A full allowance is made for the openings in estimating the quantity of materials.

EXERCISE

1. How many square yards of plaster are in the ceiling of a rectangular room 18 ft. by 16 ft.?
2. How many square yards of plaster are in the walls and ceiling of a rectangular room 22 ft. by 18 ft. and 12 ft. high?
3. Find the cost of plastering the walls of a rectangular room 30 ft. by 24 ft. and 15 ft. high at 21 ct. per sq. yard.
4. At 23 cents per sq. yd. it costs \$22.08 to plaster the ceiling of a room 24 ft. wide. What is the length of the room?
5. A room is 26 ft. long, 18 ft. wide, and 12 ft. high; it has 3 doors, each 7 ft. by 4 ft., and 4 windows, each 6 ft. by 3 ft. A baseboard a foot wide runs around the room. Find the area of the plaster (*a*) in the walls; (*b*) in the walls and ceiling.

6. At 25 ct. per sq. yd. find the cost of plastering the walls and ceiling of a rectangular room 24 ft. by 21 ft. and 12 ft. high, making no allowance for deductions.

7. By how much would the cost of plastering the room in the last example be reduced if there are 3 doors, 8 ft. by 4 ft., and 3 windows, 7 ft. by 4 ft., making full allowance for opening?

8. It costs \$108 to plaster the walls of a hall 15 ft. high at 27 ct. per sq. yd. Find the perimeter of the hall.

9. At 35 ct. per square yard find the cost of plastering the walls of a rectangular room 25 ft. by 20 ft. and 10 ft. high, there being 2 doors, 7 ft. by 5 ft., 3 windows, 6 ft. by 3 ft. and one window 5 ft. by 4 ft., deducting for windows and doors.

10. A house is 40 ft. long, 35 ft. wide, and 20 ft. high. A gallon of paint covers 300 sq. ft. of surface with two coats. At \$4.20 per gallon find the cost of the paint required to give two coats to the outside walls.

Papering

In papering it is necessary to match patterns. In practice the exact cost of papering a room is seldom determined. The approximate cost is given, making a liberal allowance for matching and for doors and windows, etc.

Wall paper is sold in single rolls 8 yards long, or in double rolls 16 yards long. It is usually 18 inches wide. Fractional parts of a roll are not sold, and the dealer will not cut a strip lengthwise. Borders are sold by the linear yard.

A paper hanger usually measures around a room, making a deduction for the doors and windows. If the paper is 18 inches wide, two vertical strips are required for each yard of the distance. No allowance for matching the pattern is

necessary for the first strip. In the succeeding strip the size of the pattern somewhat determines the allowance for matching.

EXERCISE

1. How many yards of paper 18 in. wide will be required for a room 20 ft. long, 15 ft. wide, and 9 ft. high?
2. How many square feet of plain paper will be required for a room 18 ft. 9 in. long and 15 ft. 3 in. wide, and 8 ft. high?
3. How many yards of paper 18 inches wide will paper the ceiling of a rectangular room 24 ft. by 21 ft.?
4. Find the cost of papering the walls and ceiling of a room 30 ft. by 24 ft. and 12 ft. high with paper 18 in. wide, at 25 cts. per roll of 8 yd.
5. How many rolls of paper 18 in. wide will paper the walls and ceiling of a rectangular room 27 ft. by 18 ft. and 12 ft. high?

Roofing

Shingles are considered to average 4 inches in width and are generally laid 4 in., $4\frac{1}{2}$ in., 5 in., or $5\frac{1}{2}$ in. to the weather. Shingles are put up in bundles of 250 to the bundle. Roofing is usually estimated by the *square* of 100 sq. ft. It is found that, allowing for waste, four bundles of shingles, or 1000 shingles, laid 4 inches to the weather will cover a *square* or 100 sq. ft. When laid $4\frac{1}{2}$ inches to the weather 900 shingles are required to cover the same area.

The following table gives approximately the number of shingles required to cover a square of roofing with the distances laid to the weather.

<i>Inches to the weather.</i>	<i>Number to cover a square</i>
4	1000 or 4 bundles
$4\frac{1}{2}$	900 or $3\frac{3}{5}$ bundles
5	800 or $3\frac{1}{5}$ bundles
$5\frac{1}{2}$	700 or $2\frac{4}{5}$ bundles

EXERCISE

- Find the number of shingles required to cover a rectangular surface 40 ft. by 20 ft., the shingles being laid 4 in. to the weather.
- Find the number of shingles required to cover the two sides of the gable roof of a barn 60 ft. long, each slope being 25 feet wide. The shingles are laid 5 in. to the weather.
- How many thousand shingles are required for a barn with a gable roof 50 ft. long, each slope being 20 ft. wide? The shingles are laid 4 in. to the weather.
- It requires 18 bunches of shingles to cover a gable roof 25 ft. long. How wide is each slope, the shingles being laid $4\frac{1}{2}$ in. to the weather?
- At 15 ct. per square foot what will be the cost of a tin roof for a building 36 ft. long and 19 ft. 6 in. wide?
- What will be the difference in cost between a gravel roof at 40 cts. per sq. yd., and a tin roof at 10 ct. per sq. ft., the roof being 45 ft. long and 16 ft. wide?
- Find the cost of tinning a porch roof 32 ft. long 7 ft. 6 in. wide at 12 ct. per sq. ft.
- How many bundles of shingles laid 5 in. to the weather will be required to shingle a barn with a gable roof 60 ft. long and 30 ft. wide?
- The dimensions of the gable roof of a house are 40 ft. by 20 ft. The house has a summer kitchen with roof

dimensions of 20 ft. by 15 ft. Find the cost of shingles to cover the two roofs at \$6.50 per thousand, if the shingles are laid 4 in. to the weather.

BILLS

A *Bill* is a written statement in detail of indebtedness for goods sold or for services rendered.

The *Creditor* is the person, firm, or corporation to whom the debt is owing.

The *Debtor* is the person or firm, etc. who owes the debt.

A *Receipt* is a written statement showing that the bill has been paid.

Example:

VANCOUVER, March 28th, 1920

MR. GEORGE R. WILLIAMS

Bought of

THE HUDSON'S BAY COMPANY

March	3	25 lbs. rolled oats	at 15 cents	\$ 3	75
"	3	50 lbs. flour	at \$7.50 per cwt.	3	75
"	3	6 lbs. rice	at 12 cents		72
"	12	10 lbs. granulated sugar	at 9 cents		90
"	18	5 dozen eggs	at 45 cents	2	25
"	27	4 lbs. butter	at 52 cents	2	08
				\$ 13	45

Received payment in full

March 28th, 1920

THE HUDSON'S BAY COMPANY

Per W. WILSON

EXERCISE

Make out the following bills in correct form and receipt each bill:

1. William Rogers bought of Rylands Limited, Lethbridge, Alberta: 8 yards table-cloth at \$2.75 per yard, 64 yards of cotton at 8 cents per yard, 36 yards of towelling at

18 cents per yard, 24 yards curtain scrim at 28 cents per yard, 5 yards denim at 22 cents per yard. The goods were purchased on May 6th, and the bill was paid on May 31st.

2. Joseph Sanderson bought of the Regina Hardware Co., Regina, Sask.: 3 Kootenay ranges at \$62.50 each, 6 gas ranges at \$26.75, 8 oak heaters at \$18.00 each, 3 dozen double boilers #5 at \$1.45 each, 4 dozen granite dishes #6 at 98 cents each.

The goods were purchased on August 28th, and the bill was paid on September 15th.

3. Robert Wilson in account with the Patterson Motor Co., Ltd., Montreal, Qué.

May 2, Repairing tire and vulcanizing, \$5.75, 5 gallons gasoline at 45 cents, 1 quart mobile oil at 45 cents per quart. May 9th, washing car \$1.50, 6 gallons gasoline at 45 cents, 1 pint mobile oil at 25 cents. May 14th, charging battery \$1.25, 4 gallons gasoline at 45 cents, 1 quart mobile oil at 45 cents. May 28th, greasing car 75 cents, grease 50 cents, labor adjusting car \$1.50. May 31st, storage \$8.00.

This bill was paid on June 1st.

4. Wilson School District, No. 3856, Province of Manitoba, bought of The Canadian School Supplies Company, Brandon, Manitoba: April 27th, 4 single seats #2 at \$7.45, 4 single seats #3 at \$7.25, 6 single seats #4 at \$6.75, 6 single seats #5 at \$6.25, 1 teacher's desk at \$22.50, 3 chairs at \$7.50, 6 roller blinds at \$2.35, 4 maps at \$12.75, 5 hanks raffia at 75 cents, 8 half pound packages plasticine at 90 cents per lb., 1 globe (hanging) \$13.75. This bill was paid on June 3rd.

5. Frank Buchanan bought from the United Grain Growers Company Limited, Calgary, on March 8th: 1 two-furrow horse gang-plow at \$128.75, 1 drag harrow at \$33.60, 1 double disk seed drill at \$186.70, 1 farm wagon at \$128.60, 2 sets heavy team harness at \$47.50 per set, 4 horse collars

at \$3.30 each, 1 spring tooth cultivator at \$193.25, 1 wheelbarrow at \$6.10. This bill was paid on April 17th.

6. William Robertson bought of The Smith Manufacturing Co., Ltd., Winnipeg, Manitoba, on November 15th: 11 refrigerators at \$57.00, 16 tables at \$48.00, 18 porcelain sinks at \$75.00, 8 kitchen cupboards at \$45.00, 6 gas ranges at \$28.00, 1 dozen scales at \$6.00 each. This bill was paid on December 14th.

7. Donald Holman bought of The Edgar Trading Co., Ltd., Halifax, Nova Scotia: March 2, $17\frac{1}{2}$ yards flannel at 46 cents per yard, $18\frac{1}{4}$ yards gingham at 16 cents per yard, $24\frac{1}{8}$ yards of tweed at \$2.70 per yard. March 12th, 24 yards ribbon at 12 cents per yard, 38 yards of cotton at $12\frac{1}{2}$ cents per yard, 6 pairs blankets at \$12.50 per pair, 1 dozen spools at 2 spools for 15 cents. This bill was paid on March 31st.

8. The Royal Fruit Company bought of the Creston Fruit Growers Company, Ltd., the following fruits: September 2nd, 350 cases of plums at \$1.95 per case, 45 dozen baskets of pears at 45 cents per basket, 75 dozen cases of apples at \$1.75 per case; September 5th, 78 dozen cases of peaches at \$2.45 per case, 45 dozen cases of pears at \$1.65 per case, 24 dozen cases of plums at \$1.85 per case, 16 dozen cases of apples at \$1.75 per case. This bill was paid on September 30th.

ACCOUNTS

An account is a record of a business transaction carried on by a person, firm, or corporation with another person, firm, or corporation.

The amounts charged against the person, firm, or corporation are entered on the left hand side in the *debit column*.

The amounts paid by the person, firm, or corporation are entered on the right hand side in the *credit column*.

Example:

THE HUDSON'S BAY COMPANY,
Victoria, B.C.

WILLIAM A. SMITH
address

1919			Dr.	1919			Cr.
Jan.	5	½ dz. kitchen chairs	\$ 24 00	Jan.	5	By Cash	\$ 10 00
"	8	1 sideboard	37 50	"	15	By Cash	38 00
"	15	1 rug	42 00	"	31	By Cash	75 00
"	15	1 library table	26 00				
"	24	8 yards linoleum	12 50	"	31	Balance	19 00
			<u>\$ 142 00</u>				<u>\$ 142 00</u>
Feb.	1	Balance	19 00				

EXERCISE

Prepare the following accounts, enter the items, and balance the accounts:

1. Northern Hardware Co. in account with Woods, Valance & Adams.

Debits. March 2nd, 1915, 2 dozen axes at \$2.15 each. March 12th, hardware \$350.75. March 15th, saws and hammers \$178.00. March 27th, hardware \$225.35.

Credits. March 15th, 1915, cheque \$45.00. March 18th, cheque \$250.00. March 31st, cheque \$175.00. March 31st, goods returned \$150.00.

2. William Robertson in account with A. H. Jones & Co.

Debits. May 2nd, 1918, 5 lbs. roast beef at 23¢ lb. May 4th, 2 lbs. butter at 45¢, 3 lbs. sausages at 28¢ per lb. May 6th, 5 lbs. chicken at 32¢ per lb. May 8th, 3 lbs. fish at 29¢ per lb. May 10th, 2 lbs. steak at 35¢ per lb. May 12th, 3 lbs. bacon at 65¢ per lb., 4 dozen eggs at 47 cents. May

15th, 6 lbs. lamb at 30¢. May 18th, 3 lbs. butter at 47¢ per lb., 5 lbs. roast beef at 27¢ per lb.

Credits. May 4th, cash \$2.50. May 11th, cash \$5.00. May 18th, cash \$5.00.

3. R. A. Smith opens an account with the Lunenburg Clothing Company, Ltd.

Make out an account showing the following items and balance the account at the end of the month :

May 3rd, 1 suit of clothes \$56.00, 3 shirts at \$3.50 each, 4 pairs of socks at 75 cents per pair. May 10th, raincoat \$25.00, rubbers \$2.50, half a dozen handkerchiefs at 2 for 35 cents. May 15th, paid cash on account \$40.00. May 17th, 1 pair shoes at \$7.50 per pair ; paid cash on account \$15.00. May 26th, 1 straw hat \$3.75, 3 suits of underwear \$1.50 each ; paid cash on account \$25.00.

4. W. A. Ross bought of the Western Lumber Company of Revelstoke, B. C., the following goods. An account was opened and the following items appeared for March :

March 8th, 28 boards 12 feet by 1 foot by 2 inches, 48 pieces 2''×4'' and 14 feet long ; price of lumber \$27.50 per thousand feet. March 15th, 12 bundles of shingles containing 250 to the bundle at \$6.75 per thousand ; 24 planks 12 feet long, 14 inches wide, and 2 inches thick, costing \$30.00 per thousand feet ; paid on account, \$35.00. March 24th, 75 scantlings 12 feet long, 6 inches wide, and 4 inches thick at \$25.00 per thousand feet ; 38 boards 16 feet long, 6 inches wide, and 1 inch thick at \$40.00 per thousand ; paid in cash \$50.00 on account.

Write out the account in correct form and balance the account at the end of the month.

5. The Western Lumber Company of Edmonton bought from the Revelstoke Lumber Company, Limited :

May 2nd, 2700 feet of pine at \$52.00 per thousand; 12,570 feet of spruce at \$23.00 per thousand. May 14th, 8400 cedar posts at \$9.50 per hundred; 40 bundles of shingles each bundle containing 250 at \$4.75 per thousand. May 20th, paid on account \$145.00. May 28th, 5600 feet of spruce at \$23.00 per thousand; 8500 feet of fir at \$35.00 per thousand. May 31st, paid balance of account in full.

EXERCISE

1. Telegraph poles are placed 88 yards apart along a railway. A passenger riding on a train notices that a pole is passed every 5 seconds. How fast is the train travelling per hour?

2. If 1 head of stock requires 3 tons of hay to winter, and a horse requires 15 lbs. of hay and 2 gallons of oats per day, what will it cost to winter 225 head of cattle and 10 horses during the winter season of 18 weeks? Hay is worth \$25.00 per ton and oats 72 cents per bushel.

3. A box with a cover is 2 feet long, 2 feet wide, and 2 feet deep on the outside and is made of boards 1 inch thick. What are the contents of the interior of the box in cubic inches?

4. A man plows a field 160 rods long and 80 rods wide with a plow turning a 16-inch furrow. How far does he travel in plowing this field?

5. A farmer delivered the following grain at the elevator: 155,160 lbs. of wheat, 148,784 lbs. oats, and 85,440 lbs. of barley. He received the following prices for his grain: wheat \$1.89 per bushel, oats 78 cents per bushel, and barley \$1.27 per bushel. Find the total amount he received for the grain.

6. A farmer sold his hay at \$19.50 per ton. He sold three loads; the first weighed 2965 lbs., the second weighed

3065 lbs., and the third 3225 lbs. If the weight of the wagon in each case was 1085 lbs., find the total amount he received for the hay.

7. A man builds a close board fence about his garden, which is 100 feet wide and 150 feet long. The fence is 5 feet high and the lumber 1 inch thick. What will the boards in the fence cost at \$17.50 per thousand feet? Find the cost of painting both sides of the fence at 18 cents per square yard.

8. Rule and make out in correct form the following account: William Robinson bought of The John Carson Furniture Co., Moncton, N. B.

May 2nd, 6 dining chairs at \$18.00 each, 1 sideboard at \$38.00, 2 enamel beds at \$28.00 each, 4 living room chairs at \$65.00 each. May 10th, 54 yards of carpet at \$3.50 per yard. May 15th, 20 yards of linoleum at \$1.45 per yard.

The following payments were made on account:

May 7th, cash \$38.00. May 15th, cash \$50.00. May 21st, cash \$65.00. May 28th, cash \$55.00. Find the balance due on May 31st.

9. A man has 40 acres in alfalfa from which he cuts 3 crops. From the first cutting he secured an average yield of 2650 lbs. per acre, from the second 2200 lbs. per acre, and from the third 1975 lbs. per acre. He sold the crop at \$27.00 per ton. Find the total amount of money he realized from the 40 acres.

10. Make out the following bill in correct form. Find the total cost of the products and receipt the bill.

William Smith purchased from J. R. May & Co., Yarmouth: April 2nd, 1 piece bacon weighing 3 lbs. 12 ozs. at 48 cents per lb., 3 lbs. butter at 54 cents per lb. April 3rd, $3\frac{1}{2}$ lbs. steak at 28 cents per lb., 4 dozen eggs at 38 cents per dozen, 240

lbs. potatoes at \$1.75 per bushel. April 7th, 13 lbs. 8 oz. ham at 48 cents per lb., $2\frac{1}{2}$ lbs. cheese at 38 cents per lb. Payment was made in full on April 15th.

EXERCISE

1. In 1919 there were 35,964 motor car licenses issued in the Province of Alberta. What was the revenue derived from these licenses by the Provincial Government, if the average license fee was \$18.75?

2. A man has a field $\frac{1}{2}$ mile long and 40 rods wide sowed in wheat. He finds that the average yield from this field is 27 bushels per acre. If he sells the wheat at \$1.95 per bushel, what does he receive for his crop?

3. What is the cost of painting both sides of a tight board fence enclosing a garden 60 feet long and 35 feet wide? The fence is 6 feet high, and the paint costs \$6.75 per gallon. 1 gallon of paint will cover 300 square feet.

4. Two boys having the same ability attend the same public school. One boy left school at the age of 14 and went to work; the other attended high school for 4 years until he was 18 years of age, when he went to work. When each was 30 years old, it was found that the first boy had earned \$10,320, while the second boy who had attended school 4 years longer had earned \$15,912.

Find the average earnings of each boy per year, from the time he left school until he was 30 years old.

For each year of high school what is the increase of the yearly earning power of the boy?

5. A steamer on a voyage of 2400 miles 96 rods goes on an average 14 miles 92 rods per hour. How many days will it take to complete the voyage?

6. Find the amount of the following bill of grain :

4,284 lbs. oats at 69 cents per bushel
21,480 lbs. wheat at \$1.78 per bushel
10,024 lbs. rye at \$1.75 per bushel
11,520 lbs. barley at \$1.19 per bushel

7. A young man, who attended college from October 1st to April 30th, spent the following amounts : board and room, \$245.00 ; fees and books \$91.00 ; clothing \$105.00 ; laundry \$22.40 ; athletic fees and expenses \$21.00 ; incidentals \$31.50. What were his average monthly expenses?

8. A wholesale merchant in Winnipeg wishes to ship 15,650 lbs. of merchandise from Winnipeg to Brandon by the cheapest way. He has two choices: 1st, to ship by open freight at the rate of 27 cents per cwt., plus cost of cartage which amounts to 6 cents per cwt.; 2nd, to ship by carload, paying a flat rate of \$35.00 per carload with an additional cartage charge of \$8.00. Which is the cheaper way and by how much?

EXERCISE

1. Lead weighs 11 times as much as water, and 1 cubic foot of water weighs 1000 ounces. Find the weight in lbs. and oz. of a bar of lead 8 feet long, 2 inches wide, and $\frac{1}{2}$ inch thick.

2. A school-room is 32 feet long, 28 feet wide, and 10 feet high. There are 40 pupils in attendance. How many cubic feet of air space does this provide for each pupil? How many cubic feet per pupil does your own classroom provide?

3. On a certain day a coal dealer made the following deliveries of coal : 2240 lbs., 2573 lbs., 3425 lbs., 2843 lbs., 5359 lbs., and 2560 lbs. The coal was sold at \$4.85 per ton. What was the total value of the sales?

4. A farmer delivered 4 loads of wheat at the elevator. The weights of the loads were as follows : 2356 lbs., 2754 lbs., 2580 lbs., and 2690 lbs. He was paid \$1.79 cents per bushel. How much did he receive for the wheat ?

5. A rug 14 feet long and 12 feet wide is laid on the floor of a room, leaving a margin of floor uncovered all about the room 2 feet wide. What is the total area of the floor of the room? What would it cost to lay a hardwood floor in this room, if the flooring costs \$2.25 per square yard?

✓ 6. What must be the length of a coal bin 6 feet high and 5 feet wide, which will hold exactly 10 tons of coal? One ton of coal requires 33 cubic feet of space.

7. A farmer raised 18,000 lbs. of potatoes from a field 20 rods long and 16 rods wide. What was the yield in bushels per acre from this crop?

8. On March 30th, 1918, the following stocks of wheat were in Canada : In elevators 20,525,213 bushels ; in flour mills 4,802,236 bushels ; in transit by rail 20,011,179 bushels ; in the hands of farmers 31,684,700 bushels. If the average price of wheat was \$1.79, what was the total value of the wheat supply in the country?

9. A close board fence 4 feet high is built around a garden 50 feet long and 40 feet wide. The boards one inch in thickness are nailed to two lines of scantlings 2'' by 4''. The posts are placed 10 feet apart and cost 25 cents each. Find the total cost of the lumber in the fence at \$38.00 per thousand feet.

EXERCISE

1. Reduce each of the following to yards :

(a) 43 rods 2 yards

(b) 151 rods 1 yard

(c) 5780 feet

(d) 15,280 feet

2. Reduce each of the following to rods :

(a) 16,780 feet

(b) 4840 yards

3. An aviator makes an altitude of 28,000 feet. Find the height in miles, rods, and yards.

4. Reduce to acres :

(a) 76,840 square yards

(b) 1670 square rods

5. A man put a 3-strand wire fence about his farm, which has 160 rods frontage and is 20 rods deep.

1. Find the number of yards of wire used in the fence.

2. At 7 cents per foot for wire, find the cost of the fence.

6. If a bushel contains 2160 cubic inches, how many bushels of grain will there be in a grain-bin 15 feet long, 10 feet wide, and 8 feet high?

7. If 1 cubic foot of water weighs 1000 ounces, find the weight in tons, cwt., and lbs., of the water that has fallen on a field 80 rods wide and 160 rods long, if the rainfall is $\frac{1}{2}$ an inch.

8. A man is paid 55 cents per hour. Find how much he would earn in a month of 25 working days, if he works 8 hours each day, except Saturday, when he works 5 hours, and there are four Saturdays in the month.

9. A man plows 5 acres per day. How far has he travelled at the end of the day, if each furrow plowed is 18 inches wide?

10. A man borrowed some money on April 12th, 1918 and repaid it on September 29th, 1918. How many days did he have the money?

EXERCISE

1. If 1 ton of coal requires 33 cubic feet of space, find the number of cubic feet of a ship's hold that will be required to store the coal for an Atlantic Liner which burns 242 tons of coal per day and carries a 15 days' supply on the trip.

2. A roadway 36 feet wide is built along the four sides of a city block 800 feet long and 350 feet wide. Find the cost of making the road at \$1.75 per square yard.

3. At 47 cents per cubic yard find the cost of excavating the basement of a building 120 feet long and 50 feet wide, the basement being 9 feet deep. Find the cost of laying a cement floor in the basement at 57 cents per square yard?

4. Find the cost of the shingles for the two sides of the roof of a barn, each side of the roof being 80 feet long and 35 feet wide. 1000 shingles, at a cost of \$6.75 per thousand, are required to cover 100 square feet.

5. Find the cost of laying a hardwood floor in a living room 18 feet long and 14 feet wide at \$1.75 per square yard.

6. Sound travels at the rate of 1120 feet per second. How far distant is a thunderstorm, if the time between the flash of lightning and the thunder is 8 seconds? Give your answer in miles and feet.

7. Find the cost of plastering the walls and ceiling of a room 15 feet long, 14 feet wide, and 10 feet high. There are three windows in the room each 6 feet by 4 feet, and 2 doors each 8 feet high and 5 feet wide. One-half the area of the doors and windows is deducted, and the cost of plastering is 18 cents per square yard.

CHAPTER II

COMMON AND DECIMAL FRACTIONS

Common Fractions.

A *unit* is one thing considered as an undivided whole.

A *fraction* is one or more of the equal parts into which a unit has been divided, as : $\frac{1}{2}$, $\frac{3}{4}$, $\frac{5}{6}$, $\frac{7}{8}$, $\frac{1}{9}$, etc.

The *denominator* of a fraction shows the number of equal parts into which the unit has been divided. It is written below the line in writing fractions. 8, 6, 5, 4 are the denominators of $\frac{3}{8}$, $\frac{2}{6}$, $\frac{1}{5}$, $\frac{3}{4}$.

The *numerator* of a fraction shows how many of the equal parts have been taken to make the fraction. The numerator is written above the line. In the fractions $\frac{5}{8}$, $\frac{4}{7}$, $\frac{1}{5}$, $\frac{7}{9}$, 5, 4, 1, and 7 are the numerators.

The *numerator* and *denominator* are called the *terms* of the fractions.

A *proper fraction* is one whose numerator is smaller than its denominator, as : $\frac{2}{3}$, $\frac{1}{4}$, $\frac{5}{16}$.

A *unit fraction* is a fraction having 1 as numerator.

An *improper fraction* is one whose numerator is equal to or greater than the denominator

For example : $\frac{5}{8}$, $\frac{7}{4}$, $\frac{12}{5}$.

A *mixed number* is the sum of a whole number and a fraction expressed as one number

For example : $7\frac{2}{3}$, $3\frac{4}{5}$, $24\frac{1}{4}$.

EXERCISE

Read the following :

1. $\frac{5}{7}, \frac{7}{9}, \frac{11}{17}, \frac{8}{23}, \frac{3}{8}$.
2. $\frac{15}{17}, \frac{33}{25}, \frac{17}{45}, \frac{5}{19}, \frac{11}{15}$.
3. $\frac{29}{17}, \frac{15}{31}, \frac{35}{39}, \frac{11}{4}, \frac{42}{9}$.
4. $\frac{15}{49}, \frac{23}{16}, \frac{4}{7}, \frac{15}{16}, \frac{85}{19}$.
5. $2\frac{5}{8}, 28\frac{3}{4}, 17\frac{2}{3}, 58\frac{4}{9}, 39\frac{4}{15}$

EXERCISE

Change to whole or mixed numbers :

1. $\frac{42}{6}, \frac{15}{3}, \frac{24}{8}, \frac{56}{7}, \frac{81}{9}$
2. $\frac{45}{7}, \frac{62}{9}, \frac{82}{6}, \frac{33}{5}, \frac{29}{4}$.
3. $\frac{283}{8}, \frac{561}{17}, \frac{339}{13}, \frac{471}{9}, \frac{283}{25}$.
4. $\frac{269}{17}, \frac{1728}{36}, \frac{85}{85}, \frac{580}{12}, \frac{693}{120}$.
5. $\frac{374}{28}, \frac{526}{15}, \frac{4403}{136}, \frac{989}{239}, \frac{760}{335}$.

EXERCISE

Change to improper fractions :

1. $12\frac{3}{4}, 5\frac{8}{9}, 13\frac{2}{3}$.
2. $17\frac{5}{8}, 33\frac{1}{3}, 12\frac{1}{2}$.
3. $46\frac{3}{11}, 16\frac{2}{3}, 23\frac{4}{5}$.
4. $29\frac{7}{12}, 158\frac{4}{7}, 237\frac{11}{15}$.
5. $72\frac{31}{49}, 26\frac{7}{15}, 80\frac{4}{15}$.

A fraction is reduced to its *Lowest Terms* when the terms are prime to each other.

To reduce a fraction to its lowest terms, select factors common to both terms, and cancel.

EXERCISE

Reduce the following fractions to their lowest terms:

1. $\frac{35}{45}, \frac{15}{65}, \frac{27}{57}, \frac{80}{120}.$

2. $\frac{250}{350}, \frac{39}{91}, \frac{63}{69}, \frac{168}{312}.$

3. $\frac{63}{217}, \frac{147}{189}, \frac{344}{552}, \frac{216}{648}.$

4. $\frac{56}{168}, \frac{280}{840}, \frac{153}{459}, \frac{114}{370}.$

5. $\frac{324}{432}, \frac{168}{840}, \frac{285}{570}, \frac{561}{1122}.$

Fractions having the same denominator are said to be *Similar Fractions*. Fractions not having the same denominator may be reduced to similar fractions. The smallest common denominator which may serve for several fractions is called their *Least Common Denominator*.

EXERCISE

Change to similar fractions having the least common denominator:

1. $\frac{1}{4}, \frac{3}{5}, \frac{7}{10}.$

5. $\frac{17}{30}, \frac{14}{45}, \frac{7}{15}.$

2. $\frac{1}{2}, \frac{7}{8}, \frac{5}{12}.$

6. $\frac{9}{25}, \frac{17}{55}, \frac{7}{10}.$

3. $\frac{3}{5}, \frac{4}{7}, \frac{5}{9}.$

7. $\frac{11}{60}, \frac{17}{45}, \frac{2}{3}, \frac{7}{15}.$

4. $\frac{7}{8}, \frac{2}{5}, \frac{17}{40}, \frac{3}{4}.$

8. $\frac{37}{121}, \frac{4}{11}, \frac{3}{4}, \frac{21}{44}.$

EXERCISE

Change to improper fractions, and reduce to similar fractions having the least common denominator:

1. $11\frac{3}{5}, 7\frac{3}{4}, 9\frac{1}{2}.$

5. $63\frac{2}{27}, 45\frac{1}{12}.$

2. $5\frac{7}{8}, 15\frac{2}{3}, 8\frac{1}{4}.$

6. $81\frac{9}{32}, 19\frac{7}{48}.$

3. $37\frac{11}{15}, 19\frac{7}{45}.$

7. $29\frac{5}{6}, 34\frac{1}{72}.$

4. $25\frac{4}{7}, 33\frac{1}{21}, 28\frac{2}{3}.$

8. $17\frac{4}{65}, 27\frac{1}{52}.$

Addition and Subtraction of Fractions

To add or subtract fractions, reduce the fractions to similar fractions having the least common denominator. When mixed numbers are to be added or subtracted, the fractional part may be added or subtracted separately from the whole numbers.

EXERCISE

Add or subtract as indicated :

1. $\frac{2}{3} + \frac{3}{4} + \frac{5}{12} + \frac{1}{6}.$

6. $2\frac{3}{4} + 7\frac{5}{12} + 3\frac{5}{24}.$

2. $\frac{7}{8} + \frac{5}{12} + \frac{7}{9} + \frac{3}{4}.$

7. $15\frac{5}{8} + 8\frac{4}{9} - 7\frac{7}{12}.$

3. $\frac{7}{8} + \frac{11}{15} - \frac{3}{4} + \frac{7}{12}.$

8. $7\frac{4}{7} + 5\frac{3}{5} - 8\frac{2}{5}.$

4. $\frac{4}{5} + \frac{19}{35} - \frac{2}{7} + \frac{11}{21}.$

9. $5\frac{5}{6} + 3\frac{4}{9} - 4\frac{2}{3} + 2\frac{3}{4}.$

5. $\frac{5}{12} + \frac{7}{18} + \frac{1}{4} - \frac{9}{20}.$

10. $14\frac{3}{8} + 2\frac{4}{5} - 4\frac{7}{12}.$

Cancellation in Fractions

We may divide the numerator and denominator of a fraction by the same factor. This process is called *cancellation*.

EXERCISE

Find by cancellation the value of each of the following in their lowest terms :

1. $\frac{21 \times 5 \times 12 \times 8}{3 \times 7 \times 15 \times 4}.$

4. $\frac{7}{12} \times \frac{27}{45} \times \frac{14}{245} \times \frac{56}{72}.$

2. $\frac{27 \times 36 \times 15 \times 17}{18 \times 51 \times 9 \times 4}.$

5. $\frac{8}{15} \times \frac{35}{48} \times \frac{5}{21} \times \frac{9}{26} \times \frac{91}{108}.$

3. $\frac{225 \times 72 \times 24 \times 44}{75 \times 9 \times 33 \times 8}.$

Multiplication of Fractions

To multiply a fraction by a fraction, multiply the numerators together for the new numerator, and multiply the denominators together for the new denominator.

Reduce the new fraction to its lowest terms by cancelling factors common to the denominator and the numerator.

Instead of multiplying the terms of the fraction together for the product, the process may be indicated, and the common factors cancelled.

EXERCISE

Find the product of each of the following :

1. $\frac{3}{4} \times \frac{7}{8} \times \frac{9}{10}.$

6. $3 \times 7\frac{1}{2} \times \frac{11}{45} \times 3\frac{8}{11}.$

2. $\frac{10}{12} \times \frac{13}{14} \times \frac{7}{8}$

7. $\frac{5}{8} \times \frac{12}{25} \times \frac{2}{3}$ of $4\frac{3}{5}.$

3. $\frac{7}{8} \times \frac{4}{5} \times \frac{16}{35}.$

8. $64 \times 8\frac{1}{7} \times \frac{21}{58}.$

4. $\frac{4}{7} \times \frac{5}{8} \times \frac{21}{28} \times \frac{2}{3}.$

9. $11\frac{2}{9} \times 11\frac{2}{9} \times \frac{561}{1212}.$

5. $\frac{9}{10} \times \frac{5}{21}$ of $\frac{14}{25}.$

10. $\frac{15}{16}$ of $512 \times \frac{4}{5}.$

Division of Fractions

To divide a whole number by a fraction, or a fraction by a fraction, invert the terms of the fraction which is the divisor, and multiply.

Whenever it is possible common factors should be cancelled.

EXERCISE

Find the quotient of each of the following :

1. $18 \div \frac{3}{8}.$

6. $\frac{1}{5} \div \frac{6}{5}.$

2. $8 \div \frac{2}{9}.$

7. $\frac{3}{4} \div \frac{7}{12}.$

3. $30 \div \frac{6}{7}.$

8. $\frac{5}{6} \div \frac{3}{4}.$

4. $144 \div \frac{12}{5}.$

9. $\frac{20}{27} \div \frac{5}{9}.$

5. $42 \div \frac{5}{7}.$

10. $\frac{185}{288} \div \frac{15}{22}.$

EXERCISE

Find the value of each of the following :

- | | |
|--|---|
| 1. $4\frac{2}{3} \div 2\frac{1}{8}$. | 6. $\frac{7}{8} \div \frac{1}{3}$ of $\frac{1}{2} \div \frac{3}{4}$. |
| 2. $\frac{5}{8} \div 12\frac{3}{4}$. | 7. $\frac{2}{3}$ of $\frac{6}{7} \div \frac{1}{9}$. |
| 3. $\frac{7}{10} \div 16\frac{4}{5}$. | 8. $2\frac{2}{3}\frac{5}{1} \div 36 \div 6$. |
| 4. $9 \div 4\frac{2}{3}$. | 9. $3\frac{3}{8}$ of $7\frac{1}{2} \div 6\frac{2}{3}$ of $\frac{7}{8}$. |
| 5. $28 \div 3\frac{5}{7}$. | 10. $3\frac{3}{8}$ of $1\frac{4}{5} \div \frac{1}{2}$ of $\frac{2}{16}$. |

EXERCISE

1. If 1 lb. of butter is made of $1\frac{1}{2}\frac{4}{5}\frac{3}{6}$ lb. of water, $\frac{5}{6}\frac{2}{2}\frac{9}{5}$ lb. of butter fat, $\frac{5}{5}\frac{1}{0}\frac{1}{0}$ lb. of curd, and the balance is salt, find the amount of salt in 50 lbs. of butter.

2. A cow produced in one year 7,200 lbs. of milk that tested $3\frac{1}{5}$ lbs. of butter fat per 100 lbs. of milk. Find the value of the milk if it is sold by test at 45 cents per lb. butter fat.

3. A farmer put $\frac{1}{4}\frac{1}{6}$ of his farm in wheat, $\frac{1}{8}\frac{3}{6}$ in oats, $\frac{1}{8}\frac{1}{6}$ in barley and $\frac{9}{16}$ in pasture. The remaining 20 acres of the farm are occupied by houses, stables, orchard and yards. How many acres are in the farm altogether?

Find the number of acres in (a) wheat, (b) oats, (c) barley, (d) pasture.

4. A rectangular reservoir $12\frac{1}{2}$ feet long, $4\frac{3}{5}$ feet wide and 4 feet deep is filled with water. Find the weight in tons of the water in the reservoir, if 1 cubic foot of water weighs $62\frac{1}{2}$ lbs.

5. The rainfall at Regina for a certain year was as follows : January $2\frac{1}{2}$ inches ; February $3\frac{3}{4}$ inches ; March $1\frac{1}{8}$ inches ; April $2\frac{3}{8}$ inches ; May $2\frac{4}{5}$; June $3\frac{3}{4}$ inches ; July $1\frac{7}{16}$ inches ; August $\frac{1}{2}$ inch ; September $\frac{1}{16}$ inch ; October $\frac{3}{8}$ inch ; November $\frac{9}{16}$ inch and December $2\frac{1}{2}$ inches. Find the total rainfall for the year.

6. A map is drawn so that $2\frac{1}{2}$ inches on it represents a distance of 10 miles. Find the distance in miles between two towns which are $9\frac{3}{8}$ inches apart on the map.

7. A tank 8 feet long, 4 feet wide and $6\frac{1}{2}$ inches deep is filled with pulp for making paper. How many feet of paper 2 feet 6 inches wide can be made from this pulp, the paper being $\frac{1}{16}$ inch thick, and half the volume of the pulp being lost in drying and rolling the product.

8. If in roasting meat $\frac{5}{3}$ of the weight of the meat is lost, find the weight after the roasting of a piece of meat which before roasting weighed $5\frac{3}{4}$ lbs.

COMPOUND FRACTIONS

Complex Fractions

1. Write down one-fourth of four-fifths.

$$\frac{1}{4} \text{ of } \frac{4}{5}$$

Such a fraction is called a *compound* fraction.

2. Write down 6 divided by $3\frac{4}{5}$, thus $\frac{6}{3\frac{4}{5}}$

3. Write down $4\frac{5}{8}$ divided by 7, thus $\frac{4\frac{5}{8}}{7}$

4. Write down $3\frac{1}{2}$ divided by $4\frac{5}{7}$, thus $\frac{3\frac{1}{2}}{4\frac{5}{7}}$

Definition.—Fractions like $\frac{6}{3\frac{4}{5}}$, $\frac{4\frac{5}{8}}{7}$, and $\frac{3\frac{1}{2}}{4\frac{5}{7}}$, in which there is a fraction for numerator or denominator or for both numerator and denominator, are called *Complex Fractions*.

Compound fractions are treated as multiplication of fractions.

Complex fractions are treated as division of fractions.

Example: Simplify $3\frac{3}{4}$ of $\frac{4}{5}$.

$$3\frac{3}{4} \text{ of } \frac{4}{5} = \frac{15}{4} \text{ of } \frac{4}{5} = \frac{15}{4} \times \frac{4}{5} = 3$$

Simplify $\frac{2\frac{1}{2}}{3\frac{1}{3}}$.

$$\frac{2\frac{1}{2}}{3\frac{1}{3}} = \frac{\frac{5}{2}}{\frac{10}{3}} = \frac{5}{2} \div \frac{10}{3} = \frac{5}{2} \times \frac{3}{10} = \frac{3}{4}$$

Simplify $\frac{\frac{2}{3} + \frac{1}{2}}{\frac{3}{5} - \frac{1}{4}}$.

Complete the addition and subtraction first.

$$\begin{aligned} \frac{2}{3} + \frac{1}{2} &= \frac{4+3}{6} = \frac{7}{6} \\ \frac{3}{5} - \frac{1}{4} &= \frac{12-5}{20} = \frac{7}{20} \\ \frac{\frac{7}{6}}{\frac{7}{20}} &= \frac{7}{6} \div \frac{7}{20} \\ &= \frac{7}{6} \times \frac{20}{7} = \frac{10}{3} = 3\frac{1}{3}. \end{aligned}$$

EXERCISE

Simplify :

1. $\frac{1\frac{1}{2}}{2\frac{1}{2}}, \frac{2\frac{1}{3}}{3\frac{2}{3}}, \frac{4\frac{3}{4}}{2\frac{1}{4}}, \frac{6\frac{3}{5}}{8\frac{1}{5}}, \frac{4\frac{5}{7}}{6\frac{3}{7}}, \frac{7\frac{1}{4}}{8\frac{3}{4}}, \frac{8\frac{2}{3}}{16\frac{1}{3}}$

2. $\frac{2\frac{1}{2}}{3\frac{3}{4}}, \frac{4\frac{3}{4}}{5\frac{1}{3}}, \frac{7\frac{2}{5}}{6\frac{7}{8}}, \frac{7\frac{1}{2}}{8\frac{1}{4}}, \frac{4\frac{3}{5}}{5\frac{2}{3}}, \frac{6\frac{5}{6}}{7\frac{1}{4}}$

3. $\frac{52}{3\frac{1}{4}}$

4. $\frac{3\frac{3}{4}}{5}$

5. $\frac{1\frac{4}{5}}{1\frac{17}{5}}$

6. $\frac{11\frac{1}{2}}{7\frac{17}{8}}$

7. $\frac{4\frac{2}{9}}{2\frac{3}{8}}$

8. $\frac{3\frac{4}{6}}{6\frac{7}{8}}$

9. $\frac{9\frac{7}{9}}{2\frac{1}{7}}$

10. $\frac{8\frac{2}{3}}{16\frac{1}{3}}$

11. $\frac{8\frac{3}{4}}{10\frac{5}{8}}$

12. $\frac{15\frac{3}{5}}{7\frac{4}{5}}$

13. $\frac{9}{3\frac{3}{11}}$

14. $\frac{25}{8\frac{3}{4}}$

15. $\frac{5}{57\frac{1}{2}}$

16. $\frac{27}{21\frac{3}{4}}$

17. $\frac{2\frac{2}{3} + \frac{2}{3}}{23}$ 18. $\frac{3\frac{3}{4} + \frac{2}{3}}{36}$ 19. $\frac{4\frac{1}{2} + \frac{2}{3}}{4\frac{1}{2} - \frac{2}{3}}$
20. $\frac{14\frac{1}{4} - 6\frac{1}{2}}{3\frac{1}{3} + 7\frac{1}{5}}$ 21. $\frac{4\frac{1}{2} + 6\frac{1}{8}}{9\frac{1}{3} - 3\frac{1}{4}}$ 22. $\frac{2\frac{1}{3} + 1\frac{3}{4}\frac{5}{8}}{9\frac{2}{7} - \frac{3}{11}\frac{9}{2}}$
23. $\frac{3\frac{1}{4} + 4\frac{1}{3}}{4\frac{1}{5} + 5\frac{1}{4}}$ 24. $\frac{3\frac{3}{7} \text{ of } \frac{11}{12}}{\frac{1}{33} \text{ of } 8\frac{9}{14}}$ 25. $\frac{2\frac{1}{4} + 2\frac{1}{5}}{5\frac{1}{2} \times \frac{1\frac{1}{2}}{3}}$
26. $\frac{\frac{2}{3} - \frac{2}{5}}{\frac{2}{5} + \frac{2}{15}}$ 27. $\frac{20\frac{1}{4} - 10\frac{1}{5}}{20\frac{1}{4} + 10\frac{1}{5}}$ 28. $\frac{2\frac{1}{2} + \frac{2}{3}}{3\frac{1}{2} - \frac{1}{3}}$
29. $\frac{2}{7} \text{ of } \frac{1\frac{1}{2}}{2} \times \frac{21}{22}$ 30. $\frac{2\frac{3}{4} - 1\frac{1}{2}}{\frac{3}{4} + \frac{2}{5} \text{ of } 1\frac{2}{3}}$

To find the whole number when a fractional part of it is known.

Example:

$\frac{3}{5}$ of a number is 21, find the number.

$\frac{3}{5}$ of the number is 21.

$\frac{1}{5}$ of the number is $\frac{1}{3}$ of 21, or 7.

Then $\frac{5}{5}$ of the number = $5 \times 7 = 35$.

The same result may be obtained as follows:

$\frac{3}{5}$ of the number is 21.

The number is $21 \div \frac{3}{5} = 21 \times \frac{5}{3} = 35$.

Rule. — To find a number when a fractional part of it is known, divide the known number by the fractional part, or multiply the known number by the fractional part inverted.

EXERCISE

Find the numbers, if

1. $\frac{9}{10}$ of the number is 45.
2. $\frac{8}{9}$ of the number is 72.
3. $\frac{3}{5}$ of the number is 81.
4. $\frac{5}{8}$ of the number is 105.
5. $\frac{7}{12}$ of the number is 224.

6. $\frac{11}{15}$ of the number is 605.
7. $\frac{9}{17}$ of the number is 1494.
8. $\frac{3}{5}$ of the number is 1347.
9. $\frac{4}{9}$ of the number is 4684.
10. $\frac{6}{11}$ of the number is 4146.

EXERCISE

1. What is the distance between Calgary and Winnipeg, if $\frac{2}{3}$ of the distance is 528 miles?
2. A man spent $\frac{7}{10}$ of his salary each year. If he spent \$1449, what was his salary?
3. A man sold 550 sheep and had left $\frac{4}{9}$ of his flock. How many sheep did he have at first?
4. The width of a room is $\frac{3}{4}$ of its length. The perimeter is 84 feet. What are the dimensions of the room?
5. In dressing hogs the weight is decreased $\frac{3}{11}$. What was the live weight of a hog which when dressed weighed 184 lbs.?

EXERCISE

1. A man wishes to put his grain in bags, each bag holding $2\frac{1}{6}$ bushels. Find the number of bags required for 780 bushels of grain.
2. A man owned $\frac{2}{3}$ of a business. He sold $\frac{3}{8}$ of his share for \$5477.00. What is the whole business worth?
3. If $7\frac{1}{2}$ lbs. of coffee cost $187\frac{1}{2}$ cents, what will a shipment of $507\frac{1}{3}$ lbs. cost?
4. A man earns $\$3\frac{1}{3}$ per day. He spends $\$2\frac{1}{2}$ for his board. How many days will he have to work in order to save enough to buy a suit costing $\$45\frac{1}{2}$?
5. A woman earns $\$21\frac{1}{3}$ every 6 days. How much will she earn in a month of 24 days?

6. A man owned $\frac{5}{16}$ of a farm. He sold $\frac{3}{4}$ of his share to another man, who sells $\frac{2}{3}$ of what he bought to a third man. The third man paid \$1250 for his share. What is the value of the farm?

7. A man spends \$1125 each year, which is $\frac{9}{14}$ of his salary. What is his salary?

8. Find the cost of the following goods:

2 dozen cans of salmon at 3 cans for 50 cents.

8 cans tomatoes at 2 cans for 35 cents.

15 cans corn at 3 cans for 40 cents.

3 dozen cans soup at 2 cans for 45 cents.

9. A merchant bought 5 hams which weighed $12\frac{1}{2}$ lbs., $17\frac{5}{8}$ lbs., $16\frac{3}{4}$ lbs., $18\frac{5}{8}$ lbs., and $19\frac{2}{3}$ lbs. respectively. He paid $19\frac{3}{4}$ cents per lb. Find the total cost of the hams.

10. A party of Boy Scouts set out on a journey of 25 miles. The first day they walked $6\frac{3}{4}$ miles; the second day they walked $2\frac{1}{5}$ miles farther than they walked the first day; the third day they walked $1\frac{1}{3}$ miles less than they walked the second day. They finished the tramp on the fourth day. How far did they walk on the fourth day?

EXERCISE

Simplify:

1. $\frac{3}{5} \times (\frac{1}{4} \times \frac{1}{6})$

7. $(\frac{3}{4} + \frac{5}{8}) \times (\frac{5}{9} - \frac{1}{6})$

2. $5 \times (7 - 2\frac{1}{3})$

8. $\frac{4}{5} \times (\frac{2}{3} - \frac{2}{5}) + \frac{1}{4}$

3. $(3\frac{3}{4} - 2\frac{5}{5}) \times 2\frac{1}{2}$

9. $(2\frac{1}{2} + 3\frac{1}{3} - 4\frac{1}{4}) \times 12$

4. $4\frac{1}{4} - (\frac{1}{2} \text{ of } 3\frac{4}{7})$

10. $60 - (2\frac{1}{4} + 4\frac{3}{8}) \times 8$

5. $(\frac{1}{3} - \frac{1}{4} + \frac{1}{6}) \times 5\frac{3}{5}$

11. $2\frac{1}{4} \times \frac{5}{6} \text{ of } \frac{1}{2} - \frac{3}{20}$

6. $(4\frac{1}{2} + \frac{1}{3} - 4\frac{5}{6}) \times 2\frac{2}{3}$

12. $\frac{5}{8} \text{ of } 1\frac{1}{3} + \frac{2}{9} \text{ of } 4\frac{1}{5}$

EXERCISE

1. Find the cost of three crates of eggs, each crate containing 12 dozen at $37\frac{1}{2}$ cents per dozen.

2. Find the cost of a remnant of silk containing $29\frac{3}{4}$ yards at $98\frac{1}{2}$ cents per yard.

3. A man left $\frac{2}{3}$ of his property to his wife, $\frac{1}{8}$ of it to his daughter, and the remainder to his son. The value of the son's share was \$20,900. How much did the wife and the daughter each receive?

4. A man rented a house for $\$42\frac{3}{4}$ per month. He kept the house for $3\frac{1}{4}$ years. How much rent did he pay?

5. A man spent $\frac{7}{8}$ of his income and at the end of the year had saved \$500.00. What was his income for the year?

6. What will it cost to thresh $116\frac{3}{4}$ acres of wheat at $6\frac{1}{2}$ cents per bushel, if the average yield is $36\frac{3}{4}$ bushels per acre?

7. On $\frac{2}{3}$ of my farm I planted wheat; on $\frac{2}{3}$ of the remainder I sowed oats; on $\frac{2}{3}$ of the remainder I planted barley; and on the rest, consisting of 15 acres, I sowed timothy. Find the number of acres in my farm and the number of acres each sowed to wheat, barley, and oats.

8. It requires $17\frac{1}{2}$ bushels of oats and barley mixed worth $79\frac{3}{4}$ cents a bushel, and \$5.00 worth of other feed to raise a pig until it is six months old. If the pig is marketed at the end of the six months at $18\frac{1}{2}$ cents per lb. and weighs $189\frac{3}{4}$ lbs., what profit has the owner made on the pig over the cost of the feed?

9. A man had a flock of 300 sheep. During the winter, he fed them 80 tons of hay worth $\$14\frac{3}{4}$ per ton, 36 tons of straw worth $\$3\frac{1}{3}$ per ton, and 400 bushels of oats worth $78\frac{1}{2}$ cents per bushel. What was the cost of wintering 1 sheep?

10. If each sheep will shear $9\frac{3}{4}$ lbs. of wool worth $56\frac{1}{2}$ cents a lb., and a farmer has from a flock of 300 sheep an increase of 280 lambs which are worth $\$7\frac{3}{4}$ each, what were his total returns from the flock?

11. A man sowed $18\frac{3}{4}$ acres with peas, using 100 lbs. to the acre. Find the cost of the seed at $\$3\frac{1}{3}$ per bushel. If the crop averaged $29\frac{1}{3}$ bushels per acre, find the value of the crop, if he sold it at $\$2\frac{3}{4}$ per bushel.

12. A man raised 105 bushels of potatoes per acre on a 5-acre field. By better cultivation and the use of better seed he increased the production to 140 bushels per acre. What fraction represents the increase in production? Find the total value of the increase on the 5 acres, if potatoes are sold at $\$1\frac{3}{4}$ per bushel.

13. Find the cost of the following order :

3 lbs. 5 oz. whitefish at 16¢ per lb.

2 lbs. 8 oz. herring at 22¢ per lb.

$3\frac{1}{4}$ lbs. salt salmon at 16¢ per lb.

$7\frac{3}{4}$ lbs. halibut at 32¢ per lb.

5 lbs. 3 oz. codfish at 24¢ per lb.

14. The rainfall in Edmonton during the years 1910, 1911, 1912, and 1913 was as follows :

1910 — $14\frac{2\frac{3}{5}}{5}$ inches

1911 — $20\frac{1\frac{3}{5}}{5}$ inches

1912 — $20\frac{1}{5}$ inches

1913 — $19\frac{1}{2}$ inches

Find the average yearly rainfall for these years.

15. A man spent $\frac{3}{8}$ of his income for board, $\frac{4}{25}$ of the remainder for clothes, $\frac{2}{3}$ of the remainder for insurance, and saved the remaining part amounting to \$350.00. What was his total income?

EXERCISE

1. A freight car 36 feet long and 8 feet wide is filled with wheat to a depth of 6 feet. If 1 bushel of wheat requires $1\frac{1}{4}$ cubic feet of space, find the weight of the wheat

in the car. What is the value of the shipment, if the wheat is sold at \$1.78 per bushel?

2. In making a lawn 250 feet long and 120 feet wide it was necessary to fill in earth to a depth of $2\frac{3}{4}$ feet. Find the number of loads of earth required, allowing 1 cubic yard to the load.

If the top of the lawn is dressed with black earth to a depth of 8 inches, find the cost of the earth required for the top-dressing at 45 cents per cubic yard.

3. A farmer makes a reservoir to store water for the winter. The reservoir is 60 feet long and 40 feet wide, and is filled to a depth of 6 feet. If 1 cubic foot of water contains $6\frac{1}{4}$ gallons, find the number of gallons of water stored in the reservoir.

4. A dealer bought 35 bushels of timothy seed at \$3.75 per bushel. He sold the seed at the rate of 15 cents per quart. How much did he make on the seed?

5. A man bought two farms containing the same number of acres in each. For the first he paid \$47.00 per acre, and for the second he paid \$35.00 an acre. If the two farms cost him a total of \$13,120, find the number of acres in each farm.

6. A merchant bought maple syrup in wholesale quantities, paying 95 cents per gallon. He sold the syrup in quart bottles at 50 cents per bottle. If the bottles cost him 5 cents each, find how much he would make on an order of 300 gallons.

7. A man bought the south half and the north-east quarter of a section of land. Find the cost of fencing the outside of his farm with a wire fence costing him at the rate of 17 cents per yard. Draw a diagram of the farm.

8. A merchant bought four pieces of silk containing $45\frac{1}{2}$ yards, $65\frac{1}{2}$ yards, $52\frac{3}{4}$ yards, and $74\frac{5}{8}$ yards. How many yards of silk did he buy in the four pieces? He sold the following lengths: $12\frac{3}{4}$ yards, $7\frac{1}{2}$ yards, $16\frac{5}{8}$ yards, $29\frac{3}{8}$ yards, $37\frac{1}{4}$ yards, and $28\frac{3}{8}$ yards. How much silk did he sell? How much silk did he have left?

9. If 1 ton of hay requires 512 cubic feet of space, find the amount of hay that can be stored in a barn 48 feet long, 36 feet wide, and 12 feet high. If hay is selling at \$17 per ton, find the value of the hay.

10. In a furniture factory there are employed 85 cabinet makers, who are paid 85 cents per hour for their work. They work 8 hours per day. The superintendent is paid a salary of \$185.00 per month, the manager a salary of \$250.00 per month, and the two accountants receive a salary of \$135.00 each per month. Find the total pay roll for a month of 26 working days.

Decimal Fractions

Fractions having as denominators 10, 100, 1000, etc. are usually written without the denominator by using a decimal point to indicate the fractional unit.

Examples:

$\frac{3}{10}$ is written .3 and is read 3 *tenths*.

$\frac{27}{100}$ is written .27 and is read 27 *hundredths*.

$\frac{364}{1000}$ is written .364 and is read 364 *thousandths*.

$\frac{2689}{10000}$ is written .2689 and is read 2689 *ten thousandths*.

The name of the *first* order to the right of the decimal point is *tenths*.

The name of the *second* order to the right of the decimal point is *hundredths*.

The name of the *third* order to the right of the decimal point is *thousandths*.

The name of the *fourth* order to the right of the decimal point is *ten thousandths*.

We may have decimals of the *fifth*, *sixth*, *seventh*, and higher orders, but in practice it is not usual to carry the decimal fraction beyond the *fourth* order.

It follows, therefore, that decimal fractions may be written as whole numbers are written, the denominator being indicated by the number of places to the right of the decimal point.

EXERCISE

Read the following decimal numbers :

	<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>
1.	.03	.024	.2706	.005
2.	.0006	.0503	.0064	.9005
3.	10.001	$2.6\frac{1}{2}$	$.9\frac{1}{4}$	18.004
4.	.0101	6.666	35.507	1.00032
5.	807.0029	140.004	25.025	200.002
6.	5.0055	$26.06\frac{1}{5}$	60.0006	87.878
7.	.07805	.0084	89.875	9.0063
8.	347.9638	15.0202	8.00003	736.4839
9.	19.0066	338.64	23.1001	.09009
10.	109.326	26.875	.10506	.00284

EXERCISE

Write the following numbers in figures :

1. Four and three tenths; one hundredth; two thousandths.

2. Eleven hundredths; twenty-three thousandths.
3. One hundred twenty-eight thousandths.
4. Two hundred thirty-six and nine hundredths.
5. Forty-seven thousand and fourteen thousandths.
6. Two and one thousand thirty-six millionths.
7. Ten and ten thousandths; five and five hundredths.
8. Eighteen and four ten thousandths.
9. Four thousand three hundred forty-eight and six hundred twenty-seven thousandths.
10. Five hundred and one hundred five ten thousandths.

EXERCISE

Arrange the following decimal fractions in order of magnitude, the greater fraction being written first:

	<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>
1.	.0745	.23	.853	.01985	.0698
2.	.753	.09885	.7	.0193	.6859
3.	.46589	.06	.497	.598	.0599
4.	.9593	.0983	.0099	.9	.1989
5.	.497	.0834	.1593	.4895	.075

EXERCISE

Change:

1. .5 to *hundredths*; .04 to *thousandths*.
2. .38 to *ten thousandths*; .8 to *thousandths*.
3. .45 to *thousandths*; .109 to *ten thousandths*.
4. .8 to *ten thousandths*; .075 to *ten thousandths*.

EXERCISE

Reduce the following decimals to common fractions in their lowest terms :

<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>
1. .05	.48	.025	.375
2. .75	.2125	.625	.0125
3. .008	.475	.6875	.0075
4. .5350	.00375	.0625	.53125

To reduce a common fraction to a decimal fraction, place the decimal point to the right of the numerator, annex zeros, and divide by the denominator of the common fraction, placing the decimal point in the quotient.

EXERCISE

Reduce the following common fractions to decimal fractions. Where the division is not even, carry the decimal fraction to *four* places.

<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>
1. $\frac{4}{5}$	$\frac{3}{8}$	$\frac{17}{20}$	$\frac{25}{36}$	4. $\frac{19}{9}$	$\frac{54}{15}$	$\frac{129}{36}$	$\frac{254}{45}$
2. $\frac{7}{8}$	$\frac{3}{15}$	$\frac{27}{55}$	$\frac{77}{81}$	5. $\frac{267}{85}$	$\frac{593}{125}$	$\frac{655}{275}$	$\frac{795}{350}$
3. $\frac{13}{22}$	$\frac{25}{45}$	$\frac{19}{103}$	$\frac{93}{45}$				

Addition and Subtraction of Decimal Fractions.

In adding decimal fractions, the decimals are written so that units of the same order are in the same column, tenths under tenths, etc. The decimal point of the sum is in the same column as the decimal points of the addends.

EXERCISE

Add :

1. .38, 4.73, 68.07, .483, 9.006, .0004, 128.09.
2. 5.204, 48.009, 54.0108, 620.003, 853.085.

3. .09032, 6.5946, 300.092, 8.008, 28.6947, 9.3875.
4. 654.78, 8.395, 86.808, 3.6789, .0985, .93642.
5. .75608, 43.02467, 875.57, 8.54, .375, 8.003.
6. .709, 92.014, 1246.037, 19.103, .809, .006.
7. 8.0432, 32.163, 9.0005, 2.0127, 659.873.
8. 190.375, 30.75, 56.0057, 4.875, 204.56.
9. 45.098, 89.063, 65.9856, 7.598, 863.45.
10. 289.683, .1036, .09632, 89.84, 3072.8.

In subtracting decimal fractions, the decimals are written so that units of the same order are in the same column, tenths under tenths, etc. Proceed as in subtraction of whole numbers, placing the decimal point of the remainder in the same column as the decimal points of the minuend and subtrahend.

EXERCISE

Subtract, and check your answers by addition :

- | | | | |
|--|--|---|---|
| 1. $\begin{array}{r} 3.0004 \\ 1.2429 \\ \hline \end{array}$ | 2. $\begin{array}{r} 35.27 \\ 33.296 \\ \hline \end{array}$ | 3. $\begin{array}{r} 213.082 \\ 95.193 \\ \hline \end{array}$ | 4. $\begin{array}{r} 3.0532 \\ 0.98 \\ \hline \end{array}$ |
| 5. $\begin{array}{r} 2.8706 \\ 0.89 \\ \hline \end{array}$ | 6. $\begin{array}{r} 543. \\ 467.2506 \\ \hline \end{array}$ | 7. $\begin{array}{r} 83. \\ 47.936 \\ \hline \end{array}$ | 8. $\begin{array}{r} 5. \\ 3.0345 \\ \hline \end{array}$ |
| 9. $\begin{array}{r} 1.869 \\ 0.0374 \\ \hline \end{array}$ | 10. $\begin{array}{r} 17.36 \\ 9.0184 \\ \hline \end{array}$ | 11. $\begin{array}{r} 1000. \\ 99.99 \\ \hline \end{array}$ | 12. $\begin{array}{r} 4.00875 \\ 0.639 \\ \hline \end{array}$ |

EXERCISE

From :

- | | |
|----------------------|-----------------------|
| 1. 204.1 take 36.002 | 5. 5 take 4.356 |
| 2. 2 take 1.3678 | 6. 7.0058 take 5.2099 |
| 3. 9.305 take 7.9 | 7. 2.1 take 1.897 |
| 4. .0061 take .00089 | 8. 36 take 28.654 |

Multiplication of Decimal Fractions

In the multiplication of decimal fractions proceed as in the multiplication of whole numbers, and mark off in the product as many decimal places as there are in the multiplicand and multiplier together.

EXERCISE

Multiply :

<i>a</i>	<i>b</i>	<i>c</i>
1. 56.78×4.28	$7.365 \times .184$	$.09632 \times 250$
2. $.423 \times .078$	$.0059 \times .078$	28.97×3.09
3. 7.39×9.38	75.008×4.09	$.873 \times 100$
4. $7.219 \times .0079$	2.436×7.039	5.6983×1000
5. 3.43×4.97	$.00839 \times 370$	30.049×7.09

EXERCISE

Multiply :

<i>a</i>	<i>b</i>	<i>c</i>
1. $128.05 \times .0738$	$.07094 \times 6400$	$.005 \times 3.008$
2. 78.46×1.674	96.153×8.54	879.64×36.9
3. 8.73×3.085	4.108×19.7	5.002×389
4. 79.063×500	8.0647×6.50	$.0875 \times 7000$
5. 7.00839×900	7.0009×3.004	47.008×23.09

Division of Decimal Fractions :

To divide a decimal fraction by a decimal fraction the divisor is made a whole number by moving the decimal point to the right of its lowest order. The decimal point in the dividend must be moved the same number of places to the right. The decimal point in the quotient is placed above the decimal point in the dividend.

EXERCISE

Divide :

	<i>a</i>	<i>b</i>	<i>c</i>
1.	$.786 \div .6$	$13.6967 \div .29$	$4.004 \div .7$
2.	$232.56 \div 29.07$	$2.56 \div .0032$	$40.68 \div .018$
3.	$4.8576 \div .96$	$.0864 \div 4.8$	$.00469 \div 17.5$
4.	$.0113391 \div 3.87$	$.7788 \div .012$	$769.12 \div .0368$
5.	$521.4227 \div .00893$	$11.0643 \div .039$	$.0012 \div 7.788$

EXERCISE

Divide, correct to *four* places of decimals :

	<i>a</i>	<i>b</i>	<i>c</i>
1.	$4 \div .0367$	$8.406 \div .586$	$314.18 \div 2.75$
2.	$1.3 \div .0025$	$37.032 \div .48$	$2.3256 \div 390.8$
3.	$.7463 \div 9.04$	$.00165 \div 3.6$	$15.87 \div .0094$
4.	$2.0072 \div 1.6$	$700 \div .0045$	$8.1346 \div 38.5$
5.	$.0712 \div .24$	$501.436 \div 64.3$	$6.2 \div .0005$

EXERCISE

1. The width of a rectangular field is 125.73 yards. The area of the field is 5.715 acres. Find the length of the field in rods.

2. Iron weighs 7.8 times heavier than water, and 1 cubic foot of water weighs 62.5 lbs. Find the weight of a solid bar of iron 15 feet long, 4 inches wide, and 6 inches thick.

3. Wheat is worth \$1.79 per bushel. How many bushels can be bought for \$2500?

4. A man is travelling in an automobile at the rate of 26.75 miles per hour. How long will it take him to go 252.25 miles?

5. A Jersey cow at the Manitoba Agricultural College farm gave in one year 8209 lbs. of milk which tested 5.22 lbs.

of butter fat per 100 lbs. of milk. How much butter fat did she produce in the year? What is the value of the year's butter fat at 47 cents per lb.?

6. One ton of timothy hay contains 952 lbs. of digestible nutrients. Alfalfa hay contains 51.6 lbs. of digestible nutrients for every 100 lbs. of hay. If timothy hay is worth \$26 per ton, what should be the price of alfalfa based on nutrient value?

7. Allowing 8.6 lbs. of milk to the gallon, how many gallons of milk are there in 7894.8 lbs. of milk?

8. A Holstein cow produced in one year 13,256.45 lbs. of milk containing 451.42 lbs. of butter fat. How many lbs. of butter fat per 100 lbs. of milk did this milk grade?

9. An aviator travels between London and Paris, making the journey in 1.45 hours. The total distance is 140.5 miles. At what rate per hour does he travel?

10. On a 20-acre field a man secured 768.45 bushels of wheat. At the same rate of yield per acre what would be his total crop from 240 acres?

EXERCISE

1. A grain dealer invests \$3601.25 in wheat at \$2.15 per bushel and \$3150 in oats at 87.5 cents per bushel. How many bushels of each did he buy?

2. A rectangular field is 726 yards long and contains 16.5 acres. How wide is the field?

3. The product of 4 factors is 28.515708. Three of the factors are 86, .78, and 3.9. What is the fourth factor?

4. A boat travels at the rate of 19 knots per hour. How long will it take to go 195.75 miles, if 1 knot is equal to 1.1515 miles?

5. A cow produced during the year 13,097.2 lbs. of milk which contained 449.66 lbs. of butter fat. How many lbs. of butter fat per 100 lbs. does this grade?

6. A warship made the following distance records in 4 trial trips of 1 hour length each:

First hour	19.5 miles.	Third hour	22.2 miles.
Second hour	21.75 miles.	Fourth hour	23.9 miles.

What is the average rate of the ship in miles per hour?

If 1.1515 miles is equal to 1 knot, what is the average rate of the ship in knots per hour?

7. A man bought 56,780 feet of lumber at \$23.75 per thousand feet. He sold 28,775 feet at \$26.00 per thousand and the remainder at \$27.00 per thousand. How much more did he get for the lumber than he paid for it?

8. A fast train makes a journey of 275.8 miles in 6.5 hours; a slow train requires 8.25 hours to make the same journey. What is the difference in the rates of the trains in miles per hour?

9. A farmer had a 20-acre field of alfalfa. From the first cutting he had 27.6 tons, from the second cutting 19.8 tons, and from the third cutting 17.2 tons. What was the average yield per acre? If he sold the entire crop of hay at \$23.75 per ton, how much did he receive for the crop?

10. A dealer received five carloads of coal weighing as follows: 22.815 tons, 21.86 tons, 20.187 tons, 19.885 tons, and 18.953 tons. He paid \$4.95 per ton for the coal. Find the cost of the shipment.

EXERCISE

1. The distance from Toronto to Calgary is 2064.7 miles. From Calgary to Vancouver the distance is 641.8 miles. If the passenger rate from Toronto to Calgary is 3.45 cents per mile, and from Calgary to Vancouver is 4 cents a mile, find the total cost of a railway ticket from Toronto to Vancouver.

2. A man wishes to make the return trip from Brandon to Lethbridge. The distance between these two places is 638.7 miles. If he buys two single tickets, he will pay 3.45 cents per mile going each way. If he purchases a return ticket at Brandon, it will cost him for the return trip $1\frac{1}{2}$ of the single rate of 3.45 cents per mile. What will a man save by purchasing a return ticket rather than two single tickets?

3. I wish to make the journey from Edmonton to Saskatoon, the distance being 368.3 miles. If I purchase single tickets each way, I shall pay 3.45 cents per mile for each ticket. By purchasing a return ticket at Edmonton, I have to pay for it $1\frac{1}{2}$ of the single fare. How much do I save by purchasing the return ticket?

4. A woman travels from Regina to Montreal, a distance of 1768.8 miles. What will her return ticket cost her, if the single fare is 3.45 cents per mile and the return fare is $1\frac{1}{2}$ of the single fare?

5. The distance between Quebec and Liverpool is 2800 miles. If the fare is \$133.00, what is the rate per mile?

6. The distance between Winnipeg and Vancouver is 1474.2 miles. A passenger train takes 2 days and 6 hours to make the journey. What is the average rate per hour at which the train travels, disregarding the time used for stops?

7. A farmer at Weyburn, Sask., received a shipment of goods by freight from Regina. The total weight of the shipment was 23,678 lbs. If the freight rate is \$.475 per cwt., what were the freight charges?

8. A farmer in Moose Jaw ordered the following goods from the United Grain Growers, Regina, having the goods shipped as second-class freight at a charge of \$.27 per cwt. :

1 spring tooth cultivator at \$226.20, weight 1365 lbs.

A disc harrow at \$63.55, weight 599 lbs.

1 mower at \$82.10, weight 805 lbs.

1 sulky rake at \$53.15, weight 475 lbs.

1 wagon at \$134.10, weight 1516 lbs.

Find the total cost of the order, including freight charges.

9. The distance from Winnipeg to Regina is 356.8 miles ; from Regina to Saskatoon the distance is 171.8 miles ; the direct route from Winnipeg to Saskatoon is 480.2 miles.

(a) Find how much farther a person travels going by way of Regina.

(b) If the railway fare is 3.45 cents per mile, find the difference in fares between the direct route and the route by way of Regina.

10. A man bought 36 stocker cattle, which averaged in weight 837.75 lbs. at \$.375 per cwt. It cost him \$27.50 per head to winter this stock. He sold the lot at \$.975 per cwt., the average weight of each being 1247.5 lbs. How much did he make on the transaction ?

EXERCISE

1. A farmer in the Okanagan Valley plants a 10-acre field of potatoes. His expenses are as follows : rent of land, \$25.00 per acre ; 120 bushels of seed at \$1.95 per bushel ; plowing

the land, \$35.00 ; discing and harrowing, \$25.00 ; planting potatoes, \$30.00 ; cultivating, \$27.00 ; digging potatoes, \$75.00 ; marketing, \$65.00. The average yield of potatoes was 189 bushels per acre, which he sold at \$1.35 per bushel. How much did he make per acre ?

2. Wheat requires 400 lbs. of water to mature 1 lb. of grain. Find the depth in inches of rainfall required to grow a crop of wheat which averaged 42 bushels per acre on a field containing 50 acres. 1 cubic foot of water weighs 62.5 lbs.

3. The British Columbia Electric has 245.59 miles of electric railway. In 1917 the cost of operation was \$2,448,207.00. The total earnings were \$2,700,733.00. Find the average profit per mile of railway.

4. The weekly cost of a family budget of staple foods, fuel, lighting, and rent, in terms of the average prices in Canada in 1910 and 1917 was as follows :

COMMODITIES	1910	1917	COMMODITIES	1910	1917
Beef, sirloin .	37.6 cts.	62.4 cts.	Flour . . .	33.0 cts.	64.2 cts.
Beef, roast .	26.0 cts.	41.3 cts.	Rice . . .	10.4 cts.	16.2 cts.
Pork, fresh .	18.0 cts.	29.6 cts.	Beans . . .	10.8 cts.	29.8 cts.
Pork, cured .	34.4 cts.	53.5 cts.	Sugar . . .	34.8 cts.	58.4 cts.
Bacon . . .	24.5 cts.	38.5 cts.	Potatoes . .	30.3 cts.	89.2 cts.
Eggs	61.7 cts.	92.3 cts.	Tea	17.8 cts.	22.8 cts.
Milk	48.0 cts.	62.2 cts.	Fuel, etc. .	175.7 cts.	236.5 cts.
Butter . . .	83.9 cts.	134.4 cts.	Rent	405.0 cts.	432.0 cts.
Bread . . .	66.0 cts.	104.0 cts.			

(a) Find the total cost of the family budget for each of the years 1910 and 1917.

(b) Find the difference in the cost of the weekly budget for these years.

5.

AREA AND POPULATION OF CANADA IN 1911 BY PROVINCES

PROVINCE	AREA IN SQUARE MILES	POPULATION
Prince Edward Island	2,184.4	93,728
Nova Scotia	21,428.0	492,338
New Brunswick	27,980.5	351,889
Quebec	351,872.6	2,003,232
Ontario	260,705.7	2,523,274
Manitoba	73,731.7	455,614
Saskatchewan	251,700.0	492,432
Alberta	255,280.5	374,663
British Columbia	355,850.5	392,480
Yukon	207,076.0	8,512
North-West Territories	1,921,685.0	18,481

(a) Find the total area of Canada.

(b) Find the total population of Canada in 1911.

(c) Find the number of people per square mile in each of the provinces and territories in Canada in 1911.

(d) Find the number of people per square mile for the whole of Canada.

6. A man leaves Vancouver and makes the following journey: from Vancouver he goes to Sicamous, a distance of 334.6 miles; from Sicamous he goes to Penticton, traveling 154.8 miles; thence to Nelson, a distance of 135 miles; from Nelson he goes to Calgary, 476.5 miles; and from Calgary he returns directly to Vancouver, a journey of 641.8 miles.

(a) How many miles does he travel in making the complete journey?

(b) Find the total cost of the trip, if the railway fare is 3.45 cents per mile.

7. A farmer has a herd of 28 dairy cows that produce on an average 19 lbs. each of milk per day, which grades 3.78 lbs. of butter fat per 100 lbs. of milk. He sells the product at 49 cents per lb. butter fat. What daily income does he receive from the herd?

8. The surface of a pond containing 4 acres is frozen to a depth of 15 inches. If 1 cubic foot of water weighs 62.5 lbs. and ice weighs 0.92 as much as water, find the weight of the ice in tons.

9. A warship travels 24 miles per hour. Find the time it will take to cross from Vancouver to Sydney, Australia, a distance of 7265 miles.

10. A steamship that travels at the rate of 19.75 miles per hour leaves Liverpool, crosses the Atlantic to New York, and proceeds from New York to San Francisco by way of the Panama Canal. The distance from Liverpool to New York is 3108 miles; from New York to San Francisco the distance is 5309 miles. Find in days and hours the time spent by the steamship in making the journey, neglecting time spent in making the calls.

CHAPTER III.

PERCENTAGE

The meaning of per cent.

Introductory.

This square is divided into 100 parts. Each part is $\frac{1}{100}$ of the square. We may write this part in different ways as $\frac{1}{100}$ or as .01.

Another way to write this fraction is as 1 per cent or 1%.



The shaded part of the square is $\frac{7}{100}$, or .07, or 7% of the square.

Example:

A man had 100 sheep. He sold 25 of them. What fraction of his flock did he sell?

Solution: He had 100 sheep. He sold 25 of them. He sold $\frac{25}{100}$ of his flock, or .25 of his flock, or 25% of his flock.

Per cent means per hundred or hundredths of anything.

6%, $\frac{6}{100}$ and .06 all represent the same quantity.

ORAL EXERCISE

State as per cent the following fractions :

<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>	<i>f</i>
1. $\frac{4}{100}$	$\frac{12}{100}$	$\frac{7}{100}$	$\frac{35}{100}$	$\frac{20}{100}$	$\frac{45}{100}$
2. .08	.05	.25	.30	.75	.10
3. .45	$.33\frac{1}{3}$	.09	.60	$\frac{41}{100}$	.50

State as decimal fractions the following per cents :

<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>	<i>f</i>
1. 50%	35%	75%	25%	20%	10%
2. 7%	4%	45%	8%	6%	1%
3. 12%	15%	60%	3%	9%	80%

ORAL EXERCISE

State as common fractions the following per cents :

<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>	<i>f</i>
1. 50%	25%	75%	20%	10%	40%
2. $33\frac{1}{3}\%$	$66\frac{2}{3}\%$	$12\frac{1}{2}\%$	$16\frac{2}{3}\%$	60%	80%

Learn the following table :

$10\% = \frac{1}{10}$	$20\% = \frac{1}{5}$	$25\% = \frac{1}{4}$	$50\% = \frac{1}{2}$
$75\% = \frac{3}{4}$	$12\frac{1}{2}\% = \frac{1}{8}$	$16\frac{2}{3}\% = \frac{1}{6}$	
$33\frac{1}{3}\% = \frac{1}{3}$	$66\frac{2}{3}\% = \frac{2}{3}$	$37\frac{1}{2}\% = \frac{3}{8}$	

Note. — In using the per cents given in the table above, it will be found that knowing their equivalent values in common fractions will enable one to do more rapid work.

All other per cents are more easily worked by using the decimal form. For example $6\% = .06$, $8\% = .08$, $15\% = .15$, etc.

EXERCISE

Express as decimals or as common fractions the following per cents :

	<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>	<i>f</i>
✓ 1.	35%	16%	25%	50%	7%	75%
✓ 2.	45%	20%	9%	11%	$33\frac{1}{3}\%$	$12\frac{1}{2}\%$

EXERCISE

Express as per cents the following fractions

	<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>	<i>f</i>
✓ 1.	.12	.65	.07	.45	$\frac{1}{4}$	$\frac{1}{10}$
✓ 2.	.17	.03	$\frac{1}{3}$	$\frac{1}{8}$	.85	$\frac{1}{5}$
✓ 3.	$\frac{2}{3}$	$\frac{3}{4}$	.52	.06	$\frac{1}{8}$	.09

To find any per cent of a number.

Example:

Find 7% of \$500.

$$1\% \text{ of } \$500.00 = \$5.00$$

$$7\% \text{ of } \$500.00 = 7 \text{ times } \$5.00 \text{ or } \$35.00$$

The work may be shortened thus :

$$7\% \text{ of } \$500.00 \text{ is } .07 \text{ times } \$500.00 \text{ or } \$35.00.$$

Rule. — To find the per cent of any number, multiply the number by the per cent expressed as a decimal fraction.

Example: Find $33\frac{1}{3}\%$ of \$660.00.

Since $33\frac{1}{3}\%$ is the same as $\frac{1}{3}$,

$$33\frac{1}{3}\% \text{ of } \$660.00 \text{ is } \frac{1}{3} \text{ of } \$660.00 \text{ or } \$220.00.$$

Note. — Use this method in dealing with the per cents given in the table of per cents and common fractions.

EXERCISE

Work the following examples, using the method of changing the per cent to decimal fractions and multiplying :

- ✓ 1. Find 7% of : 856 ; 642 ; 1345 ; 3456 ; \$5675 ; \$3750.
2. Find 6% of : 3456 ; 1785 ; 5467 ; 3450 ; 6850 sheep.
3. Find 15% of : 657 ; 458 ; 3245 ; \$750 ; \$857 ; 9845 bushels.
- ✓ 4. Find 45% of : 345 ; 1785 ; 5678 ; \$750 ; \$450 ; 875 acres.
5. Find 60% of : 758 ; 3456 ; 5675 ; \$3250 ; 8750 lbs. ; 986 acres.

EXERCISE

Work the following examples, using the method of changing the per cents to common fractions :

1. 25% of : 4356 ; 2360 ; 7852 ; 6472 ; \$4800 ; \$3660.
2. 10% of : 3560 ; 7580 ; 6450 ; 32,790 ; \$5600 ; 5470 acres.
3. $33\frac{1}{3}\%$ of : 27,690 ; 14,919 ; 20,505 ; \$450 ; \$765 ; 717 acres.
4. $12\frac{1}{2}\%$ of : 5160 ; 3132 ; \$3000 ; \$3416 ; 5246 bushels.
5. 20% of : 4200 ; 6570 ; 32,560 ; \$4500 ; \$6700 ; 68,750 lbs.

EXERCISE

1. A farmer had 4500 bushels of wheat. He sold 25% of it. How many bushels did he sell ?
2. A pupil had 25 problems to work on the examination paper and worked 60% correctly. How many were correct ?
3. A rancher bought 375 head of stockers. He afterwards sold 28% of them. How many did he sell ?
4. A man bought a house for \$8500.00 and sold it to gain 12%. How much did he gain ?

5. A man owns a half section of land. 75% of it is broken, 10% is in hay meadow, and the remainder is in pasture. How many acres are there broken? How many acres are in hay meadow? How many acres are in pasture? What per cent of the land is in pasture?

6. A farmer has 480 acres in crop. 45% of it is in wheat, 20% of it is in barley, 15% of it is in rye, and the rest is in oats. How many acres are sowed in each of the following: wheat? barley? rye? oats? What per cent of the land is sowed in oats?

7. 122,250 vessels arrived at and departed from Canadian ports in 1917. Of these 60% were foreign ships, 32% were Canadian ships, and the remainder were British. Find the number of each of the foreign, Canadian, and British ships.

8. In 1913, 402,400 immigrants came to Canada. Of these 37% came from the British Isles, 34% came from the United States, and the remainder from other countries. Find the number of immigrants from each of these three divisions.

9. In 1917, Canada exported goods and products valued at \$1,151,375,768.00. Of these exports 65% were sent to Great Britain, 24% were sent to the United States, and the remainder to the other countries. Find the value of the exports to each of these divisions.

10. The total value of the fisheries of Canada in 1917 was \$52,312,044.00. Of this amount British Columbia marketed 41%, Nova Scotia, 28%, New Brunswick, 12%, and the remaining provinces of Canada the balance. Find the value of the fish marketed in 1917 in British Columbia; in Nova Scotia; in New Brunswick; in the other provinces of Canada.

To find what per cent one number is of another.

Introductory.

3 is what part of 12? *Ans.* 3 is $\frac{3}{12}$ or $\frac{1}{4}$ of 12.

3 is what decimal part of 12? Since 3 is $\frac{1}{4}$ of 12, it is .25 of 12.

3 is what per cent of 12? Since 3 is $\frac{1}{4}$ or .25 of 12, it is 25 % of 12.

ORAL EXERCISE

1. 4 is what fractional part? decimal part? per cent of 8?
2. 5 is what fractional part? decimal part? per cent of 10?
3. 6 is what fractional part? decimal part? per cent of 60?
4. 8 is what fractional part? decimal part? per cent of 100?
5. 75 is what fractional part? decimal part? per cent of 100?

Example:

A man bought 250 sheep and sold 50 of them. What per cent of them did he sell?

50 is $\frac{50}{250}$ of the 250 sheep, which is $\frac{1}{5}$ of the sheep, or .20 of the sheep or 20% of the sheep.

To shorten the work:

.20 or 20%

250 sheep $\overline{)50}$. sheep

Divide 50 by 250 adding the decimal place and annexing zeros.

EXERCISE

What per cent of

- | <i>a</i> | <i>b</i> | <i>c</i> | <i>d</i> |
|---------------|------------|-------------|-------------|
| 1. 32 is 8? | 40 is 4? | 42 is 7? | 48 is 36? |
| 2. 870 is 58? | 375 is 45? | 750 is 120? | 684 is 456? |

3. ✓ 928 is 116? 738 is 123? 832 is 624? 650 is 52?
 4. ✓ 1950 is 273? 920 is 414? 156 is 101.4? 238 is 21.42?
 5. 673 is 87.49? 856 is 59.92? 329 is 55.93? 283 is 118.86?

In some cases it is not possible to find an exact per cent, as for example: What per cent is 27 of 59?

Example: Find what per cent of 59 is 27.

$$\begin{array}{r}
 .457 \\
 59 \overline{)27.000} \\
 \underline{236} \\
 340 \\
 \underline{295} \\
 450 \\
 \underline{413} \\
 37
 \end{array}$$

In this case the division is carried out to 3 places. To correct the work to 2 places, we disregard the third place, but if the third figure is 5 or more we increase the second figure by 1. Correcting the answer to 2 places we have .46 or 46%.

Note. — In finding per cent statements the work should be carried out to three places and corrected to 2 places of decimals. If the figure in the third place is less than 5, the second figure is not changed; if the figure in the third place is 5 or over, the second figure of the quotient should be increased by 1.

EXERCISE

- Find what per cent 35 is of each of the following: 56, 79, 136, 459.
- Find what per cent 56 is of each of the following: 97, 765, 832.
- Give the relation in per cent of 693 to 1384.
- What per cent of 947 is 856?
- What per cent of 2359 is 1785?
- What per cent of 7634 is 2390?
- What per cent of 5467 is 119?

8. What per cent of 3567 is 379?
9. What per cent of 6531 is 283?
10. What per cent of 65,789 is 43,785?

EXERCISE

1. A man bought 480 acres of land. He broke 160 acres of it. What per cent of the farm did he break?
2. On an examination a boy worked at 24 problems. He had 16 correct. What per cent of his problems were correct?
3. In a seed test 400 seeds were planted and 348 germinated. What was the per cent of germination?
4. A cow in a year gave 8160 lbs. of milk that produced 354.96 lbs. of butter fat. What per cent did the milk grade?
5. A man's income is \$2800 per year. He spends \$2016 and saves the balance. What per cent of his income does he save?
6. The population of Calgary in 1911 was 43,704. In 1916, the population was 56,514. What per cent of the population of 1911 is the increase during the five-year period?
7. In 1911, the population of the Prairie Provinces was 1,328,725. In 1916, the population was 1,698,220. What per cent of the population of 1911 is the increase during the five-year period?
8. In 1911, the population of Canada was 7,206,643. Of these, 3,925,679 lived in the country, and the remainder lived in the towns and cities. What per cent of the population lived in the country, and what per cent of the population lived in the towns and cities?
9. In 1915, there were 13,267,023 tons of coal produced in Canada. Alberta and British Columbia produced 5,426,431 tons of this. What per cent of the coal produc-

tion of Canada was produced in Alberta and British Columbia in 1915?

10. In 1918, the total revenue of the Dominion of Canada was \$260,778,953.00. Of this revenue \$144,172,630 was raised from customs duties, \$25,379,901 from special war tax, and \$21,345,394 from the post office service. Find what per cent of the total revenue was raised in 1918 by

- (1) Customs duties.
- (2) Special war tax.
- (3) Post office service.

EXERCISE

1. A man saves \$560.00 during the year. If he spent 65% of his income, what was his total income for the year?

2. In 1917, 2063 pupils attended the public schools in Lethbridge. In 1918, there were 2369 pupils. What was the per cent increase over 1917?

3. In 1916, there were 47,978 pupils enrolled in rural schools and 51,223 pupils enrolled in graded schools in Alberta. Find what per cent of the total enrolment there were in (1) rural schools, (2) graded schools.

4. A man had two fields of 20 acres each. The first was summer-fallow and produced a crop of 785 bushels. The second was spring plowing and produced a crop of 432 bushels. What was the per cent increase of the crop on summer-fallow over that on spring plowing?

5. Four farmers decide to buy a carload of coal. The car contains 66,800 lbs. of coal. The cost of the coal was \$3.75 per ton. The first man took 40% of the coal, the second 15%, the third 25%, and the fourth the remainder. How much should each pay?

6. A house valued at \$6500.00 is damaged by fire to the extent of \$2500.00. What per cent of the value of the house is the damage?

7. In 1917, Canada exported 155,782,000 lbs. of cheese to Great Britain; the same year she exported 411,000 lbs. to the United States, and 1,205,000 lbs. to other countries. Find what per cent of her total export of cheese went: (1) to Great Britain; (2) to the United States; (3) to other countries.

8. The total amount of wheat grown in the world in 1917 was 2,241,100,000 bushels. Canada produced 233,743,000 bushels, the United States produced 650,539,000 bushels, and British India produced 379,306,000 bushels. These three countries were the leading wheat producing countries of the world. What per cent of the world's 1917 crop did each of these countries produce?

9. In 1917, there were 105,998 Indians in the Dominion of Canada. There were in the same year 11,583 in Manitoba, 10,646 in Saskatchewan, 8837 in Alberta, and 25,694 in British Columbia. Find what per cent of the total Indian population lived in: (1) Manitoba; (2) Saskatchewan; (3) Alberta; (4) British Columbia.

10. During the European war Canada enlisted 595,441 men. If her population was 7,206,643, what per cent of the population was the total enlistment?

EXERCISE

1. At the Ontario Agricultural College at Guelph a dairy test was made of a herd of Holstein cattle:

Cow No. 1 gave 16,736 lbs. of milk testing 3.67% butter fat.

Cow No. 2 gave 15,976 lbs. of milk testing 3.78% butter fat.

Cow No. 3 gave 21,030 lbs. of milk testing 3.59% butter fat.

Cow No. 4 gave 11,523 lbs. of milk testing 3.47% butter fat.

Cow No. 5 gave 16,466 lbs. of milk testing 3.65% butter fat.

Find the total weight in lbs. of the butter fat produced by the herd in the year. If butter fat is worth 49 cents per lb., what is the total cash return from the product?

2. In milling wheat into flour, approximately 83% of the weight of wheat is made into flour. Find the amount of flour that can be made from the wheat grown on 160 acres, which yielded a crop averaging 38 bushels to the acre. What is the value of the flour at \$4.50 per hundred lbs.?

3. A man earns \$2400.00 per year. His expenditures are \$65.00 per month for board, \$450.00 for clothes, and \$250.00 for insurance. He saves \$600.00 per year. What per cent of his yearly salary does he spend: (1) for clothes; (2) for board; (3) for insurance? What per cent of his yearly salary does he save?

4. A wheat crop removes from the soil 2.4% of its weight of nitrogen, 0.9% of its weight of phosphorus, and 0.6% of its weight of potassium. Find the total weights of each of these soil ingredients removed from a field of 80 acres of wheat which produces an average yield of 36 bushels of grain per acre, and an average yield of 1.75 tons of straw per acre.

5. In 1916, there were employed by the railways of Canada 144,770 persons who received in salaries and wages \$104,300,647.00. In 1917, there were 146,175 employees receiving in salaries and wages \$129,626,187.00. Find the average amount earned by an employee in (1) 1916,

(2) 1917. Find the increase per cent in the average amount earned by an employee in 1917 over the amount earned in 1916.

6. In 1916, the attendance of pupils at school in the four Western Provinces was as follows: Manitoba, 103,796; Saskatchewan, 125,590; Alberta, 99,201; British Columbia, 59,800. In 1917, the attendance was as follows: Manitoba, 106,588; Saskatchewan, 138,731; Alberta, 107,727; British Columbia, 60,277. Find the total enrolment for the four provinces for (1) 1916, (2) 1917. Find the increase per cent for each of the provinces. Find the increase per cent in the total attendance for the four provinces.

7. During the year 1918, 2130 ships passed through the Panama Canal. Of these 699 were British, 628 belonged to the United States, 52 were French, 53 were Japanese, 296 were Norwegian, and 204 belonged to South American countries. Find the per cent of the total ships which passed through the canal for each of the above countries.

8. The average yearly wages for farm help in the Western Provinces in 1917 were \$752.57. In 1916, the average yearly wages were \$483.00. Find the increase per cent.

9. The total value of the mineral products of British Columbia for the year 1917 was \$37,010,392.00. The value of the gold was \$2,863,190; of silver \$2,265,749; of copper \$16,038,256; of coal \$10,690,172. What per cent of the total value is the value of each of the mineral products?

10. A farmer raised 25% more wheat in 1919 than in 1918. His total crop for the two years was 6750 bushels. How much did he raise each year?

CHAPTER IV

SHARING AND PARTNERSHIP, AVERAGES AND PROPORTIONAL PARTS

I. Sharing and Partnership

Introductory.

John Smith and David Jones agree to carry on business together and share the profits and the losses in proportion to the sum of money each has in the business. If Smith puts in \$2000 and Jones \$2000, how should a profit of \$500.00 be shared?

An association of two or more persons in business with an agreement to share the profits and losses is a partnership. The association is called a firm or company. The persons associated are the partners. The money or property invested in the business is the capital or stock.

EXERCISE

1. Divide 198 into two parts proportional to 4 and 7.
2. Divide 198 into three parts proportional to 5, 6, and 7.
3. The sum of two numbers is 1260, and they are to each other as 57 and 48. What are the numbers?
4. Divide \$500 among three persons, A, B, and C, so that the three portions may be to each other as the numbers 5, 9, and 6 respectively.

5. A bankrupt has three creditors to whom the sums due are as the numbers 3, 4, and 5. If his assets are valued at \$600, find the sums they will respectively receive.

6. Divide 540 into three parts proportional to 3, $3\frac{1}{2}$, and 7.

7. Divide 915 into five parts proportional 1, 2, 3, 4, and 5.

8. Divide 1815 into three parts which shall be to each other as $2\frac{1}{2}$, $3\frac{1}{3}$, and $4\frac{1}{4}$.

9. Three brothers raise 510 bu. of potatoes. How many bushels did each raise if their amounts are to each other as 9, 10, and 11?

10. A farmer shipped a carload of wheat and oats containing 875 bu. in parts proportional to $\frac{1}{2}$ and $\frac{1}{3}$. Find the number of bushels of each.

11. In a certain school 48% of the pupils are boys, and there are 39 girls. Find the number of boys.

EXERCISE

1. A and B engage in a wholesale business. A invests \$6000 to B's \$4000. They gain \$1250. What is each one's share of the gain?

2. A, B, and C buy a house for \$2500. A pays \$500, B \$1200, and C \$800. They rent it for \$300. What is each one's share of the rent?

3. A man dying willed to his son \$6500, to his widow \$8000, and to his daughter \$5500; but his estate amounted to only \$12,000. How much did each get?

4. A and B jointly rented a pasture for \$24. A put in 36 cows and B 24 cows. How much of the rent ought each to pay?

5. A, B, and C hired a carriage for \$15.75, each agreeing to pay in proportion to the number of miles he rode. A rode 90 mi., B 75 mi., and C 60 mi. What part of the hire ought each to pay?

6. A and B were engaged in business two years, making an annual profit of \$8190. A owned $\frac{2}{3}$ of the stock. What was each partner's share of the total profits?

7. A, B, C, and D formed a partnership with a capital of \$30,000. A furnished \$6000, B \$7000, C \$8000, and D the remainder. They gained 18% of the joint stock. What was each partner's share of the profit?

8. A, B, and C carry on a coal business. A invests \$8500, B \$9000, and C \$12,000. At the end of the year B's share of the gain is \$4050. Find the total gain.

9. Three men engaged in business. A received \$90, B \$115, and C \$148 of the profits. C's capital was \$740. What was the total capital?

10. A, B, and C enter into partnership. A invests \$700 and receives \$105 as his share of the profits. B invests \$580, and C's share of the profits is \$18. Find B's profits and C's capital.

11. A, B, and C are partners in a business in which A has invested \$5000, B \$3000, and C \$2500. C receives $12\frac{1}{2}\%$ of the profits as manager; the remainder is divided among them all in proportion to the capital of each in the business. What does each receive of \$340 profits?

12. The cargo of a ship was worth \$25,000 and was insured for \$17,500. If the cargo belonged to A, B, and C in proportion to 1.4, 1.5, and 1.6 respectively, how much would each lose in case the vessel was lost?

13. In a mixture of 360 gal. of wine and water, there is 1 qt. of water to every gallon of wine. How many gallons of each are there in the mixture?

14. Divide \$9282 among A, B, C, and D, giving to A 10% more than to B, to B 10% more than to C, and to C 10% more than to D.

15. There are three books, A, B, and C. A and B together contain 900 pages, B and C together 845 pages, and C and A together 1025 pages. How many pages are there in each book?

16. A, B, and C enter into partnership. A puts in \$10,500, B \$7500, and C \$13,500. The total gain is \$4725. What per cent of this should A receive?

17. A, B, and C rent a pasture for a season for \$38. A puts in 50 sheep for 12 weeks, B 15 sheep for 15 weeks, and C 25 sheep for 5 weeks. How much of the rent should each pay?

EXERCISE

1. Divide \$1117.60 among A, B, and C so that A may have twice as much as C, and B \$10 more than three times as much as C.

2. A man spent \$240.25 in cloth at \$1.55 a yard and sold it to 3 men. The first man bought 35 yd. more than 3 times the second one and 20 yd. more than the third man. Find the number of yards bought by each man.

3. A man sold three sheep for \$37. For the first he received \$3.00 more than for the third and \$4.00 less than for the second. What did he get for each?

4. The cost of a quantity of silk at \$3.25 per yard and tweed at \$2.50 per yard was \$409.75, the whole cost of the tweed being 25 cents more than that of the silk. Find the number of yards of each kind of cloth.

5. The cost of 12 bu. of oats and 17 bu. of wheat was \$14.97. The cost of a bushel of wheat was 42 cents more than that of a bushel of oats. Find the cost of a bushel of wheat.

6. Mary had two dollars in five and ten-cent pieces. The number of ten-cent pieces is two more than the number of five-cent pieces. How many of each kind has she?

7. A farmer employs a number of men and 8 boys. He pays the boys 65 cents and the men \$1.10 per day. The amount that he paid to all was as much as if each had received 92 cents per day. How many men were employed?

8. The quantity $93\frac{1}{8}$ is the sum of a certain number of ninths, three times as many tenths, and five times as many twelfths. What are the values of the three aggregate parts of the quantity?

9. A farmer bought a number of horses and cows for \$2000. There were three times as many cows as horses, and a horse cost twice as much as a cow. If each horse cost \$80.00, how many cows did he buy?

10. Divide $45\frac{1}{2}$ bu. between A and B, so that when A gives B $\frac{1}{8}$ of his (A's share), their shares may be equal.

II Averages

1. Find the aggregate and the average of the following :

(a) 250, 306, 402, 211, 309.

(b) $7\frac{1}{2}$, $3\frac{1}{4}$, $4\frac{1}{8}$, $5\frac{7}{8}$, $7\frac{3}{4}$.

(c) 7.5, 5.34, 8.75, 3.48, 6.23.

2. The school register shows that 34 pupils were present on Monday, 32 on Tuesday, 35 on Wednesday, 33 on Thursday, and 36 on Friday. Find the average attendance during the week.

3. The elevation of certain places above the sea level is as follows: find their average elevation:

(a)	Calgary	3410 ft.	Red Deer	2806 ft.
	Summit	3627 ft.	Battle River	2627 ft.
	Olds	3402 ft.	Edmonton	2188 ft.
(b)	Fernie	3302 ft.	Crow's Nest	
			Lake	4424 ft.
	Michel	3853 ft.	Macleod	3128 ft.
	Crow's Nest	4438 ft.	St. Mary's	
			River	2795 ft.
(c)	Winnipeg	757 ft.	Virden	1444 ft.
	Portage La	854 ft.		
	Prairie		Wolseley	1950 ft.
	Carberry	1258 ft.	Indian Head	1924 ft.
	Brandon	1194 ft.	Regina	1885 ft.

4. What number substituted for each of the addends 36.2, 18.5, 27.3, 36.4, 25.2 will give the same sum?

5. The aggregate weight of 6 boys is 465 lbs. The average weight of four of them is 79.5 lbs. Find the average weight of the remaining two.

6. A farmer received \$17.40 for 8 turkeys which he

sold at 15 cents a pound. Find the average weight of a turkey.

7. Six boys weigh on the average 115 lbs. One weighs 135 lbs. Find the average weight of the other five.

8. Find the average length of four boards which are 12 ft. 6 in., 14 ft. 4 in., 16 ft. 6 in., and 16 ft.

9. Eight blocks of granite weigh as follows: 17.4 cwt., 18.5 cwt., 15.8 cwt., 12.75 cwt., 14.25 cwt., 16.3 cwt., 15.5 cwt., and 18.2 cwt. Give their average weight in lbs.

10. In a cricket match the scores of one side were the following: 0, 24, 10, 32, 0, 0, 6, 8, 2, 11, 6. Find the average score per man.

11. The mean height of five mountains is 7850 ft., and the mean height of 4 of them is 5912 ft. Find the height of the fifth mountain.

12. A grocer sold 3 lbs. of tea at 75 cents per lb. and 2 lbs. at 50 cents per lb. What was the average price?

13. Two purchases have been made of 15 lbs. weight at \$2.50 per lb. and 25 lbs. at \$1.80 per lb. What is the average price per lb.?

14. The average temperature of the different months during the past 37 years at Toronto was: of Jan. 22.94°, Feb. 22.58°, March 29.05°, April 40.63°, May 51.68°, June 61.84°, July 67.43°, Aug. 66.32°, Sept. 58.10°, Oct. 45.74°, Nov. 36.03°, Dec. 25.57°. What was the average yearly temperature during that period.?

15. In a class there were six boys whose respective heights were 4 ft. 5 in., 4 ft. 6 in., 5 ft., 4 ft. 7½ in., 4 ft. 9¾ in., and 4 ft. 1¾ in. what was the aggregate of their heights and their average heights?

16. A mixes 25 gal. of water with 125 gal. of vinegar, which cost him 36 cents per gallon. How much must he charge per gallon so as to make a profit of $33\frac{1}{3}$ per cent?

17. The average price paid for a farm of 320 ac. was \$16.25. 80 ac. cost \$2240, 160 ac. cost \$12.50 per acre. Find the average price per acre of the remainder of the farm.

18. A farmer sold 125 head of cattle at \$37.74 per head, 142 head at \$42.50, and 238 head at \$45. Find the average price he received for them.

III. Ratio and Proportion

EXERCISE

Introductory.

1. John has \$10; James has \$5.00. John has how many times as much money as James?

2. What is the relation of a line 3 in. long to one 1 in. long?

3. How many times 5 is 20?

4. A quart is what part of a gallon?

5. How many pecks make a bushel?

6. What is the relation of \$24. to \$6?

The relation of one quantity to another similar quantity in respect to size is called the *Ratio* of the two quantities.

7. (a) An hour is what part of 2 hr.?

(b) What is the ratio of 1 hr. to 2 hr.?

8. What is the ratio of the following:

(a) 8 to 16?

(d) 24 mi. to 6 mi.?

(b) \$15 to \$5?

(e) \$12 to \$36?

(c) \$20.00 to \$10.00? (f) 18 marbles to 3 marbles?

9. How is the ratio of two quantities found? The first of the two quantities is called the *Antecedent*, the second the *Consequent*.

Ratio is usually indicated by placing a colon between the two quantities. Thus the ratio of 8 to 4 is written 8:4 and is read 8 is to 4.

Ratio is also expressed by the sign of division, thus $8 \div 4$. It is also expressed by writing the numbers in the form of a fraction, thus $\frac{8}{4}$.

Hence 8:4, $8 \div 4$ and $\frac{8}{4}$ all denote the same relation.

10. Name the antecedent and consequent of each of the following ratios:

- | | |
|-------------------|-------------------|
| (a) 9 mi. : 3 mi. | (d) 3 qt. : 4 qt. |
| (b) 15 : 3. | (e) 5 ft. : 7 ft. |
| (c) \$18 : \$9. | (f) 3 yd. : 2 ft. |

11. Express the ratio of each of the following.

- | | |
|---------------------|--|
| (a) \$6 to \$18. | (d) 16 lb. to 3 lb. |
| (b) \$4 to \$20. | (e) 15 apples to 5 apples. |
| (c) 5 hr. to 30 hr. | (f) $2\frac{1}{2}$ to $1\frac{3}{4}$. |

12. The ratio of 8 to 4 is the same as the ratio of 12 to what number?

13. Find the number that will bear the same ratio to 12 that 5 bears to 15.

14. The ratio of 20 to 5 is equal to the ratio of 24 to what number?

15. Find a fourth term of each of the following ratios:

- | | | | |
|-------------|--------|----------------------------------|--------|
| (a) 36 : 12 | 6 : ? | (d) 5 : 8 | 25 : ? |
| (b) 56 : 7 | 24 : ? | (e) $1\frac{2}{3} : \frac{1}{5}$ | 21 : ? |
| (c) 25 : 5 | 55 : ? | (f) 54 : 9 | 72 : ? |

When four quantities are so arranged that the ratio of the first to the second equals the ratio of the third to the fourth, the four quantities form a *Proportion*.

A proportion is usually indicated by writing a double colon ($:$ $:$) between the equal ratios. Thus. $8:6::12:9$.

The first and fourth terms of a proportion are the *Extremes*. The second and third terms are the *Means*.

16. Name the extremes and the means in each of the following proportions:

(a) $25:7::50:14$.

(b) $36\text{ hr.}:7\text{ hr.}::72\text{ mi.}:14\text{ mi.}$

17. In each of the following proportions, compare the product of the extremes with the product of the means:

(a) $7:5::14:10$.

(b) $84:12::21:3$.

(e) $12:24::36:72$.

18. In a proportion, how does the product of the means compare with that of the extremes?

19. Find the omitted term in each of the following:

(a) $12:6::4:?$

(b) $35:6::4:?$

(c) $5:8::10:?$

EXERCISE

Example: Find the cost of 12 lbs. of sugar, if the cost of 4 lbs. is 25 cents.

The ratio of 12 lbs. to 4 lbs. is 3. Hence 12 lbs. will cost 3 times as much as 4 lbs., or 75 cents.

1. If it requires 250 lbs. of coal to run an engine for 6 hr., how much coal will be required to run this engine for 9 hr.?

2. If a pole 18 ft. high casts a shadow 25.5 ft. long, how long a shadow will be cast by a pole 31.5 ft. high?

3. If 156 bu. of wheat are required to make 44 bbl. of flour, how many bushels will be required to make 77 bbl?

4. If John's money is to Henry's as 4 to 5, and Henry has \$20, how much has John?

5. If 60 sheep were sold for \$450, how much should 96 sheep bring at the same rate?

6. If \$360 gains \$28 in a given time, how much will \$900 gain in the same time?

7. If 24 men can dig a ditch in 5 days, in how many days can 36 men dig a similar ditch?

8. If $\frac{2}{3}$ yd. of cloth costs $\$ \frac{7}{8}$, find the cost of $\frac{5}{6}$ yd.

9. If 120 men earn \$2000 in a given time, how many men will earn \$2500 in the same time?

10. If 32% of an estate is worth \$5200, how much is 75% of the estate worth?

11. How far can a man walk in 12 da. of 8 hr. each, if he can walk 189 mi. in 7 da. of 9 hr. each?

12. The ratio of the weight of white pine to the weight of white oak is 17 to 27. A cubic foot of oak weighs 54 lbs. Find the weight of a cubic ft. of white pine.

13. A man earns \$1300 in a year of 52 weeks. How much does he earn per week?

Review Exercise

1. A merchant bought 845 bu. of wheat for \$574.60 and sold it at 85 cents per bu. Find his profit and his gain per cent.

2. A can do $\frac{1}{4}$ of a piece of work in 4 days, and B $\frac{1}{4}$ of it in 5 da. In what time can they do the whole working together?

3. Divide 120 into three parts, so that the second part shall be double the first and the third part as much as the sum of the other two parts.

4. If a man can build $\frac{1}{7}$ of a wall in $8\frac{2}{3}$ da., how long will it take him to finish it?

5. How many board feet are there in 24 planks, 15 ft. long, 16 in. wide, and 6 in. thick?

6. If the divisor were one-fourth what it is, the quotient would be 948 and the remainder 85. Find the dividend, the divisor being 400.

7. At \$6.50 per cord, find the cost of a pile of wood 120 ft. long, 60 ft. wide, and 15 ft. high.

8. What fraction increased by 16% of itself becomes $\frac{2}{3}$?

9. Find the cost of 3 bu. 2 pk. 1 gal. 1 pt. of oats at \$1.75 a bushel.

10. Find the result when five hundred and twenty-five ten-thousandths are taken from ten thousand and the remainder is multiplied by ten hundredths.

11. A lady spent \$63 for jewellery and dress goods, paying 16% more for dress goods than for jewellery. How much did she pay for each?

12. If 78 be added to a certain number, it will contain eighty-seven 1005 times. Find the number.

13. Simplify .6 of $4\frac{2}{3}$ of $\frac{8}{\frac{2}{3} \text{ of } 6}$

CHAPTER V

APPLICATIONS OF PERCENTAGE

Trade Discount

Wholesale merchants, manufacturers, and publishers usually catalogue their goods at certain fixed prices and then allow a certain deduction from these prices to purchasers. The price in the catalogue is called the *list*, *invoice*, or *catalogue* price. Goods catalogued but not subject to these deductions are marked *net*.

The allowance or deduction made by the wholesale merchants, manufacturers, etc. upon their catalogue prices is called *Commercial* or *Trade Discount*. The price after all discounts have been taken off is called the *Net Price*.

The cataloguing of prices with discounts given enables the wholesalers and manufacturers to meet the fluctuations in the market price by increasing or decreasing the rate of discounts, thus avoiding the frequent publication of large catalogues. It also enables them to meet cash payments and short-term payments.

Sometimes a second or third discount is given. When more than one discount is given, the first discount is reckoned on the list price, and the second is reckoned on the remainder after the first discount has been deducted, and so on. No two successive discounts are reckoned on the same

amount, and, therefore, the single discount equivalent to successive discounts can never be found by adding the successive discounts. These discounts are quoted separately, so that a buyer may take advantage of one or two of the discounts, even though he may be unable to take advantage of the three.

Many merchants have "bargain sales" annually or more frequently to dispose of stock which they have had on hand for some considerable time, or as a means of advertising their business. At such sales they usually sell their merchandise at a certain "per cent off," or at a certain per cent discount. For example, merchandise marked \$6.00 with 15% off, would sell for \$6.00 - \$.90, or \$5.10. Some sales are advertised thus: "Goods selling at $\frac{1}{3}$ off," which means that a discount of $33\frac{1}{3}\%$ of the marked price is given.

Introductory.

Example: Find the net price of goods invoiced at \$375.00, there being two successive discounts of 20% and 5%.

The invoice price is	\$375.00
The first discount is 20% of \$375.00	<u>75.00</u>
The first reduced price is ;	\$300.00
The second discount is 5% of \$300.00	<u>15.00</u>
The net price is	\$285.00

ORAL EXERCISE

1. On goods listed at \$60.00 a discount of 20% is allowed. Find the discount and the net price.
2. What is due on a bill of \$600.00 subject to a discount of 10%?
3. Cloth is marked at \$1.20 per yard, and a discount of $33\frac{1}{3}\%$ is given. What is the sale price per yard?

4. The invoice price of hardware received is \$800.00 subject to a discount of $12\frac{1}{2}\%$ for cash. What is the cash price?

5. The list price of goods is \$150.00, and the net price is \$120.00 after one discount has been allowed. What was the rate of discount?

6. How much will you pay for goods invoiced at \$80.00, the rate of discount being 25% ?

7. A retailer bought hardware listed at \$450 and got a discount of $33\frac{1}{3}\%$ for cash. How much did the hardware cost him?

8. At a bargain sale a \$30 chair was sold at a discount of 20% . For how much did it sell?

9. A dining room suite was marked \$250 and advertised for sale at a discount of 30% . What was the advertised selling price?

10. A bookseller receives from the publishers a discount of 20% from the list price. How much does he make on a book listed at 75 ct., if he sells it for \$1.00?

11. Find the net price of the following bills:

(a) Invoice price \$640.00 discount 25% .

(b) Invoice price \$248.00 discount $12\frac{1}{2}\%$.

12. A piano was listed at \$600.00 with a discount of $33\frac{1}{3}\%$ and another discount of 10% for cash. Find the cash price.

EXERCISE

1. Find the amount of the following bill:

30 doz. spoons at \$5.40 per doz., less $33\frac{1}{3}\%$.

5 doz. knives at \$6.20 per doz., less 25% .

18 doz. forks at \$5.50 per doz., less 10% .

3 doz. water glasses at \$3.60 per doz., less $12\frac{1}{2}\%$.

2. A merchant bought 720 yards of cotton at 25¢ per yard, less $16\frac{2}{3}\%$. He retailed all of the cloth at 30¢ per yard. What was his profit?

3. A dealer buys motor cars from the manufacturer at a discount of 22% off the list price. If the list price of a car is \$1500 and the freight and expenses of handling amount to \$120.00 what does the dealer make on this car if he sells it for \$1650.00?

4. What is due on a bill of \$500.00 subject to a discount of 20% and 5%?

5. Find the net amount of a bill of \$1600, with 25%, 10%, and 5% off.

6. On a bill of goods listed at \$300.00, I am offered a single discount of 45%, or successive discounts of $33\frac{1}{3}\%$, 10%, and 5%. Which is the better offer and by how much?

7. What is the difference on an invoice of \$340.00 between a discount of 40% and successive discounts of 25% and 15%?

A wholesale firm usually indicates on its invoice forms the terms of payment as, Terms: 60 days net, 5% 30 da., 10% cash, which means that a buyer is entitled to 60 days credit, but will be allowed 5% discount if the bill is paid within 30 days, or 10% discount for cash.

The following is a common form of invoice of goods purchased from a wholesale firm :

HALIFAX, N. S., June 10, 1919.

MESSRS. MCLEOD & SIMPSON,
TRURO, N. S.

Bought of W. R. JONES & SONS,
PUBLISHERS, MANUFACTURERS, STATIONERS,
No. 806 Barrington Street.

TERMS: 60 da. net: 2% 30 da.

6 doz. Geometry Sets at	\$ 6.00	\$ 36 00	
5 gro. Pens, assorted at	1.20	6 00	
4 gro. Pen Holders at	2 00	8 00	
		50 00	
Less 25 %		12 50	\$ 37 50
Less 2 %			75
			\$ 36 75

The foregoing invoice shows that the trade discount listed on these goods is 25% and also shows that the goods were paid within 30 days.

Make out an invoice for the following: 20 brass bedsteads at \$25.00, 30 mattresses at \$15.00, 20 kitchen chairs at \$1.50. Discounts listed on these goods are 25% and 10%. Terms, 5% 30 days.

Example:

What single discount is equal to discounts of 20% and 5%?

The first discount is 20% of the list price.

The first reduced price = $\frac{80}{100}$ of the list price.

The second discount is 5% of the first reduced price.

The second reduced price = $\frac{95}{100}$ of (the first reduced price).

= $\frac{95}{100}$ of ($\frac{80}{100}$ of the list price).

= $\frac{76}{100}$ of the list price.

The total discount = $\frac{24}{100}$ of the list price.

The single discount equivalent to the two discounts = 24%.

EXERCISE

1. Find the single discount equivalent to 25% and 10% off.
2. A merchant buys goods listed at \$500.00 with discounts of 20% and 5% off. He sold these goods at \$600.00, allowing discounts of 25% and 10%. What was his profit?
3. I bought 10 binders at \$225.00 each, less 20% discount, and 15 mowers at \$80.00 each, less 25%. Terms of payment are 60 da. net; 5% 30 da. Find the net amount paid for these implements, if the bill is not paid for 60 days; if the bill is paid within 30 days.
4. Find a single discount equivalent to discounts of 25% and 5%.
5. Find a single discount equivalent to 25%, 10%, and 5%.
6. A dealer buys a book, list price \$2.50, at a discount of 20%. He sells the book for \$2.50. What is his rate of gain?
7. The net price of goods after discounts of 20% and 5% have been taken off is \$190.00. Find the list price of the goods.
8. A dealer bought a piano, the list price of which was \$250.00 with discounts of 20% and 5%. He sold it at 10% above the list price. What was his gain?

9. Two wholesale firms offer the same quality of goods at the same list price. The first firm offers a discount of 10% and 5% , and the second offers a single discount of 15% . What is the difference in their offers on a bill of goods, the list price of which is \$2500.00?

GAIN AND LOSS

If an article cost \$20 and is sold for \$24, what is the gain?

If an article cost \$20 and is sold for \$16, what is the loss?

When is an article sold at a gain? At a loss?

How is the amount of gain calculated?

How is the amount of loss calculated?

In business transactions the gain or loss is calculated as a certain per cent of the cost of the article sold. In this cost is included freight charges, cartage, and all overhead charges such as rent, insurance, etc.

Introductory.

Examples:

1. A merchant buys goods for \$30.00 and sells them at a gain of 20% . Find the selling price.

The gain is 20% or $\frac{1}{5}$ of \$30 = \$6.00

The selling price \$30.00 + \$6.00 = \$36.00

2. A merchant buys goods for \$50, and sells them at a loss of 10% . Find the selling price.

The loss is 10% or $\frac{1}{10}$ of \$50.00 = \$5.00

The selling price is \$50.00 - \$5.00 = \$45.00

3. A dealer sold an article that cost him \$20.00 for \$24.00. What is his rate of gain?

Amount of gain $= \$4.00$
 \$4.00 is the gain on \$20.00, or the gain $= \frac{4}{20}$ of the cost
 $= \frac{1}{5}$ of the cost
 $= 20\%$ of the cost
 rate of gain $= 20\%$.

ORAL EXERCISE

1. An article costing 20 cents was sold at a gain of 25%. What is the sale price?

2. A merchant sold goods that cost him \$120.00 at a gain of $33\frac{1}{3}\%$. Find the selling price.

3. A dealer sold goods at 10% below cost. The goods cost \$300. Find the selling price.

4. An article which cost \$50.00 was sold for \$60.00. Find the rate of gain.

5. A dealer in clothing bought a suit of clothes for \$48.00 and sold it for \$54.00. What is his rate of gain?

6. A book costing \$1.20 was sold for 80 cents. What was the loss per cent?

7. What is gained by selling a hat that cost \$3.00 at a gain of 20%? What is the selling price?

8. A crate of berries worth \$6.40 was delayed in shipment and was sold at a loss of 25%. What was the selling price?

9. A newsboy buys papers at 3 cents each and sells them at 5 cents each. What is his rate per cent gain?

10. A merchant sold a carpet for \$160.00 that cost him \$200.00. Find the rate per cent of loss.

11. In each of the following examples supply the rate per cent of gain:

	<i>Cost</i>	<i>Gain</i>	<i>Rate per cent of gain.</i>
(a)	10¢	1¢	?
(b)	25¢	5¢	?
(c)	60¢	20¢	?
(d)	\$80	\$10	?
(e)	\$60	\$40	?

EXERCISE

1. A shoe dealer bought shoes at \$6.00 per pair and re-tailed them at \$8.00 a pair. Find his rate of gain.

2. A merchant buys hats at \$8.00 per dozen and sells them at \$1.50 each. Find his rate of gain.

3. A grocer bought 1200 bushels of potatoes at 60 cents a bushel. He sold $\frac{2}{3}$ of them at a gain of 25% and the remainder at a loss of $12\frac{1}{2}\%$. Find his gain.

4. A coal dealer buys a carload of 30 tons of coal at \$4.00 per ton. The freight cost him 90 cents a ton and the delivery 60 cents a ton. For how much per ton must he sell this carload to make a gain of $33\frac{1}{3}\%$?

5. A grain dealer bought 12,000 bushels of wheat at \$1.80 per bushel and 6500 bushels of oats at 55 cents per bushel. He sold the wheat at a gain of $16\frac{2}{3}\%$ and the oats at a loss of 20%. What amount did he gain or lose on the whole transaction?

6. A man paid \$1500 for two lots, the cost of one of them being double that of the other. He sold the cheaper lot at a gain of 50% and the dearer one at a loss of 20%. Find his gain or loss per cent on the sale of these lots.

7. Brooms are bought wholesale at \$120.00 per gross. What per cent gain will be made by selling them at \$1.00 each? ✓

✓ 8. I bought a section of raw land at \$20.00 per acre and had 120 acres broken at a cost of \$4.00 per acre. I enclosed the section with a barbed wire fence, the labor and material costing at the rate of 25 cents per rod. What per cent gain would I make, if I accepted an offer of \$30.00 per acre for the section?

9. A grain dealer sold 4000 bushels of oats for \$300.00 less than the cost, his rate of loss being $16\frac{2}{3}\%$. What did the oats cost him per bushel?

✓ 10. A news agent on the train buys his oranges at 30 cents per dozen and sells them to the passengers at 3 for 10 cents. Find his rate of gain.

✓ 11. A merchant bought 720 yards of cotton at 25 cents per yard. He marks the cotton at an advance of 40% of the cost, but, not finding a ready sale, he sells the goods at a discount of 20% off the marked price. Find his gain from the sale.

✓ 12. The Dunlop Dairy Company buys milk from the farmers at \$2.50 per 10 gallons and retails the milk to its customers at 8 quarts for \$1.00. What per cent gain is the company making, if it costs $2\frac{1}{2}$ cents per quart for delivery?

EXERCISE

1. A merchant sold a coat for \$24.00 and thereby gained 20%. What did the coat cost him? What rate of gain would have been made had he sold it for \$28.00?

✓ 2. A coal dealer raised the price of coal 50 cents per ton and by so doing made a gain of 50% instead of 40%. What did the coal cost him per ton?

3. A merchant sold a carpet for \$150.00. He was able to collect only 90% of the sale price, yet made a gain of 5%. What did the carpet cost the merchant?

4. A clothier sold a suit of clothes for \$40.00 and made a gain of 25%. The material in the suit cost one-third as much as the tailor's charges. What did the tailor receive for making the suit?

5. A buyer bought a carload of 20 steers, averaging 1250 pounds each, at \$8.00 per cwt. In shipping them to the Winnipeg market they lost 4% in weight. What price per cwt. must he receive for them to make a gain of 20%?

6. A shoe merchant sold shoes at 20% less than the marked price, but still made a gain of $16\frac{2}{3}\%$. If the shoes cost him \$4.80 per pair, at what price were they marked?

7. I bought out a dry goods business for \$40,000.00 and at the end of each year invested one-half the profits for that year in the business. The first year I gained 20%, the second year $12\frac{1}{2}\%$, and the third year 10%. Find the amount of money invested in the business at the end of the third year.

8. A hardware dealer buys a bankrupt stock at 60 cents on the dollar on the list price of the stock. This stock is sold at a sale at a discount of 10% off the list price. What is the dealer's rate of gain? If the list price of the stock was \$15,000.00, find the amount of money he made in handling this bankrupt stock.

COMMISSION

The charge made by a person or firm for transacting business for another person or firm is called *Commission*.

The farmer who ships his grain or cattle to Winnipeg or Calgary cannot always take the shipment to these markets himself and therefore requires some person or firm to represent him in these cities, in order that he may sell at the best price. The compensation received for these services is called *Commission*. A merchant in Canada may employ some person in London, England, to buy and ship him certain kinds of goods. The person in London would receive a *Commission* for his services.

A person may also transact other business for another person such as the collection of accounts, the selling of farm or city property, etc.

Commission is usually reckoned at a certain per cent of the money involved in the transaction. If goods are sold, the commission is a certain per cent of the selling price ; if goods are bought, the commission is a certain per cent of the cost price ; if collections are made, the commission is a certain per cent of the amount of the collections.

The person who transacts business for another is called an *Agent*, and, according to the work he does, is spoken of as a *Commission Merchant*, *Broker*, *Collector*, etc.

The total amount received by the agent for the goods sold is called the *Gross Proceeds*.

The amount left after the commission and other charges such as freight, storage, etc. have been deducted, is called the *Net Proceeds*.

The importance of the commission business in Canada has

greatly increased through marked development in agriculture, industry, and commerce.

Introductory.

Example:

A real estate agent sold a farm for \$8000. He charges a commission of $2\frac{1}{2}\%$. What is his commission? What does the owner of the farm receive from the sale?

Selling price of farm = \$8000

Rate of Commission = $2\frac{1}{2}\%$

Commission = $\$8000 \times .025$
= \$200

Owner receives $\$8000.00 - \$200$, or \$7800.00

ORAL EXERCISE

1. At 20% , what is the commission on a \$250 sale?
2. What does a collector receive for collecting a debt of \$90.00 at 10% commission?
3. A real estate dealer sells a house for \$3000.00, charging 5% commission. What is the amount of his commission?
4. Working on a 20% commission, a boy during the year earned \$100.00 selling papers. What did his sales amount to during the year?
5. A man took orders for a grocery store receiving $12\frac{1}{2}\%$ of his sales as commission. For the first week his commission amounted to \$48.00. What was the amount of his sales for this week?
6. Find the commission at 2% on 2000 bushels of wheat sold at \$1.50 per bushel.
7. I received \$200 for buying goods at 5% commission. What was the cost of the goods?

8. A rental agent receives 3% for collecting rents. If his collections amount to \$500.00 per month, what will be the amount of his yearly commission?

9. What is the architect's commission on a building costing \$4500.00, if his rate of commission is 5%?

10. An agent charged \$150.00 for selling a farm for \$3000.00. What rate of commission did he charge?

EXERCISE

1. A collector was successful in collecting 80% of a debt of \$5000.00. What is his commission at 15%? How much did the creditor receive?

2. A farmer takes some butter, eggs, and vegetables to a commission merchant in the city who sells them for \$175.00, charging 5% commission. What is the net amount received by the farmer?

3. A real estate dealer sells a quarter section of land at \$30.00 per acre, charging $2\frac{1}{2}\%$ commission. What is the amount of his commission? How much per acre does the owner of the land receive?

4. An agent for an automobile company receives a commission of 20% on all sales. In one month he sold three cars at \$800.00 each and two others at \$1300.00 each. If his expenses connected with the sale of these cars amounted to \$250.00, what were his net monthly earnings?

5. A commission merchant sold 30 boxes of oranges, each box containing 15 dozen, at 45 cents per dozen, charging 10% commission. What was his commission?

6. A farmer ships three cars of wheat, each car containing 1250 bushels, to a commission merchant in Winnipeg, who sells it for \$2.25 per bushel. After paying \$75.00 per car

for freight, 5 cents per bushel storage charges, and 1 cent per bushel commission for selling, what will be the farmer's net proceeds from the sale of the wheat?

7. A rancher ships a carload of 24 steers, averaging 1450 pounds each, to the United Grain Growers in Winnipeg, who sell at \$9.75 per hundred on a commission of 1%. The expenses connected with the shipment were as follows: 750 lbs. of hay at \$16.00 per ton for feed on the road, \$80.00 freight charges, and \$8.50 yardage. Find the rancher's net proceeds from the sale of the steers.

8. An architect charges 3% of the cost of a building for plans and specifications and 2% for supervising the construction of the building. What would be his total commission on a building costing \$15,000?

EXERCISE

1. An agent sent his employer \$4230.00 as the net proceeds from the sale of a car of fruit and retained \$270.00 as his commission. What was the rate of his commission?

2. A fruit broker sold \$680 worth of apples, and, after deducting 5% commission and 20% for freight and other charges, invested the balance in oranges. If he invested \$500.00 in oranges, what rate of commission did he charge for the investment?

3. A farmer in Southern Alberta ships three cars of baled alfalfa, each car containing 15 tons, to a commission merchant in Calgary, who sells it for \$20.00 per ton. He retained \$36.50 to pay charges amounting to \$9.50 and his commission. What rate of commission did he charge?

4. A grain broker buys 15,000 bushels of wheat for his firm at \$1.80 per bushel, charging 1% commission. He then

sells it at an advance of 15 cents per bushel, also charging 1% for selling. Find the firm's net gain and his total commission.

5. An auctioneer's commission for selling a bunch of 40 horses was \$220. The rate of commission charged was 5%. What was the average sale price per head?

6. The total cost of a building, including the architect's commission of \$287.50, was \$6037.50. Find the rate of commission charged by the architect.

7. For selling city property a real estate agent charges a commission of 5% on the first \$1000.00 and $2\frac{1}{2}\%$ on all over \$1000.00. Find the agent's commission for selling a house and lot for \$6500.00.

INSURANCE

Security or indemnity against loss or damage of any kind is called *Insurance*. There are two kinds of insurance, *Property Insurance* and *Personal Insurance*. The more common forms of property insurance are :

(1) *Fire Insurance*, indemnity for loss by fire.

(2) *Marine Insurance*, indemnity for loss or damage of vessels or their cargoes through accidents of navigation.

(3) *Live Stock Insurance*, indemnity for loss of horses, cattle, etc. by lightning or other specified causes.

(4) *Hail Insurance*, indemnity for loss of standing crops by hail.

(5) *Transit Insurance*, indemnity for loss or damage to merchandise during transportation from one place to another.

The principal kinds of personal insurance are *Life*, *Health*, and *Accident*. Personal insurance guarantees to the insured or his heirs a certain specified sum in case of sickness, accident, or death.

Companies guaranteeing an indemnity in case of loss resulting from certain causes are called *Insurance Companies*.

The written contract or agreement between the Insurance Company and the insured (person protected) is called a *Policy*. It states the conditions under which the indemnity against loss is made, the time the contract is to be in force, the rate, and other essential facts. The amount of indemnity or protection is called the *Face of the Policy*.

The sum paid the Insurance Company for the protection is called the *Premium*.

Insurance rates are stated in per cent, or in cents per \$100.00, or in dollars and cents per \$1000. The rates of insurance on property vary with the kinds of buildings, their location with reference to other buildings, the efficiency of the fire protection in the community, etc.

Life Insurance is the most important kind of personal insurance. There are many kinds of life insurance policies, but the three most important types of policies are :

(1) *Straight or Ordinary Life*. The straight life policy requires the payment of premiums throughout the whole life. In the case of straight life insurance protection and not investment is most desired. It affords to the insured the greatest amount of permanent protection for his outlay. As the premiums are paid throughout life, they are the lowest that will give genuine protection. The straight life

policy is attractive to the poor man, because it enables him to carry an amount of protection which he could not afford at a higher cost.

(2) Limited Payment Life. The limited payment life policy is payable at death with premiums spread over a fixed number of years, as 20 years, when the policy is said to be "paid up." This is probably the most popular insurance contract, as it is free from the objection of continuous premium payments and involves a moderate degree of investment. For men in early and middle life the annual premium is not excessive, and it is required only while earning power is at a maximum.

(3) Endowment. Endowment insurance is a protection and an investment. The endowment policy is frequently termed a *Savings Bank Insurance*, the reason being that under the endowment the important feature is the compulsory saving that it involves. There is protection, but for a fixed term of years only, as for ten, fifteen, or twenty or more years. At the end of this period, the assured himself receives the amount of the policy. If death occurs during the term of the endowment, the amount of the policy is paid to the beneficiary or heir of the insured. The amount of the annual premium varies with the length of the endowment term; the shorter the term the higher the premium.

NOTE. — The teacher should familiarize the pupils with the object and principal advantages of each of these types of policies.

The amount of the premium in life insurance depends upon the age of the person insured and the kind of policy. The rate is stated in dollars and cents per \$1000.

ORAL EXERCISE

1. What is the premium on a \$600 policy at 3%?

2. What is the premium on a \$2000 policy at \$1.25 per \$1000?

3. Find the premium on a brick house insured for \$6000 at 25 cents per \$100.

4. Find the premium on a \$1750 policy at 2%.

5. What must be paid to insure a vessel for \$50,000 at 1%?

6. A house is insured for \$5000 at 35 cents per hundred. What is the premium?

7. A man insured his house for \$3600 and his personal property for \$1400 at 60 cents per hundred for three years. Find the premium.

8. A ship worth \$80,000 was insured for $\frac{3}{4}$ of its value at \$1.00 per hundred. Find the premium.

9. I pay \$96 annually for a life insurance of \$3000. What is the rate per thousand?

10. A merchant insures his store valued at \$6000 for $\frac{3}{4}$ of its value at 1%. What does the insurance cost him?

11. What is the premium on a \$4000 policy at \$29 per \$1000?

12. The premium for insuring some property at 2% was \$72. What was the face of the policy?

EXERCISE

1. I have my house insured for \$3000 at $\frac{4}{5}$ % and the contents of the house for \$1600 at $\frac{3}{4}$ %. Find the amount of my premium.

2. A merchant insured his stock of goods valued at \$18,000 for $\frac{5}{6}$ of the value at \$1.45 per \$1000. What was the premium?

3. A merchant had 1200 barrels of flour worth \$5.80 per barrel insured for $\frac{3}{4}$ of its value at $1\frac{1}{3}$ %. Find the premium paid.

4. A vessel is carrying 32,000 bushels of wheat worth \$1.75 per bushel. The wheat is insured for $\frac{7}{8}$ of its value at 65 cents per \$100. Find the amount of the premium. What will be the owner's net loss if the cargo is destroyed? What will be the insurance company's net loss?

5. A farmer insures his growing wheat against damage by hail for \$2400. What premium does he pay at 8%?

6. My house is insured for \$5000 for 3 years and my premium for this period is \$30. What per cent of the face of the policy is the premium? What is the rate per \$1000? What is the rate per cent per year?

7. A factory building worth \$60,000 is insured for $\frac{3}{4}$ of its value at $1\frac{2}{3}\%$. The machinery and stock worth \$40,000 are insured for $\frac{7}{8}$ of the value at 2%. The building and contents are completely destroyed by fire. Find: (1) the net loss to the insurance company; (2) the net loss to the owner.

8. I have my motor car, which is valued at \$1800, insured with the London & Lancashire Fire Insurance Company for 90% of its value, against fire, theft, and collision. The fire rate is 1%, the theft rate $\frac{3}{4}\%$, and the collision rate $2\frac{1}{2}\%$. Find the amount of premium paid to this company for my motor insurance.

EXERCISE

1. A man carries a health policy which guarantees him \$25 per week in case of sickness. This insurance cost him \$35 per year. During four years he was sick 5 weeks and drew his full insurance during that time. What was the net cost to him of his protection for the four years?

2. A man at the age of 25 years took out a 20-payment life policy for \$2000, the rate of premium being \$29.50 per \$1000 yearly. What is the amount of his premium for the

first five years? If he dies after paying ten premiums, how much more do his beneficiaries receive than was paid to the company in premiums?

3. A grain merchant in Winnipeg ordered his agent at Calgary to buy 10,000 bushels of wheat at \$1.75 per bu., 4000 bushels of oats at 85 cents per bu., and 3200 bu. barley at \$1.10 per bu., paying his agent 2% commission for buying. A policy at $1\frac{1}{2}\%$ was taken out to cover the cost of the grain and commission as protection during transit from Calgary to Winnipeg. Find the amount of the policy and the premium paid.

4. A grain dealer bought 4000 bu. of wheat and had it insured at $\frac{3}{4}$ of its cost at $2\frac{1}{2}\%$. His premium was \$112.50. What did the wheat cost him per bushel?

5. A merchant paid \$60 for insuring his stock of goods worth \$6000 for $\frac{2}{3}$ of their value. What was the rate of insurance?

6. A shipment of goods was insured for \$6000. This sum covered the value of the goods, \$5930, the premium, and \$2.50 expenses. What was the rate of insurance?

7. At the age of 40 years the annual premium on an ordinary life policy is \$35 for \$1000. Every five years the dividends decrease the premium by 20%. What would it cost to carry \$5000 of such insurance for 10 years?

TAXES

Money is required by the Dominion, Provincial, and Municipal Governments for public purposes. The Provincial and Dominion Governments expend money in public

works, in erecting and maintaining public institutions, in paying the salaries of public officials, etc. Municipalities expend money in erecting and maintaining municipal buildings, the building and repairing of roads and streets, maintaining schools and hospitals, providing proper sewerage and sanitary conditions, providing fire and police protection, in paying the salaries of municipal officials, etc. All the above expenses are met by money levied by proper officials on property, on business, or on persons. This money is called a *Tax*.

For purpose of direct taxation, there are two kinds of property, *Real* and *Personal*. Real property comprises property that is fixed or immovable, such as land, buildings, mines, railroads, etc. Personal property consists of movable property, as money, bonds, merchandise, live stock, household goods, etc. Besides the property tax there are other kinds of tax. In some municipalities a *Poll Tax* of a certain sum is levied on all male persons over twenty-one years of age, without regard to property or income. A tax is also levied on a person according to his income by the Dominion Government and by many municipalities. This is called an *Income Tax*. Usually a certain part of the income is exempt, and only the remaining part of the income is liable to taxation.

When the tax is paid directly by the person who is to bear the burden, it is a *Direct Tax*. The tax levied on articles of merchandise brought into the country or on merchandise made in this country, is called an *Indirect Tax*. This tax is called *indirect* because while paid to the government by the importer or manufacturer, it is added to the selling price of the merchandise and therefore indirectly paid for by the person who buys the goods.

The Township, Town, or City Councils appoint officers called *Assessors* or *Assessment Commissioners*, who estimate the value of all the taxable property in the municipality. Assessors report to the Council the name, address, and estimated value of all property, real and personal, of each resident of the municipality. This report is called the *Assessment Roll*.

When the Municipal Council has decided what the expenditure for the year will be, it proceeds to determine the rate of taxation. This is found by dividing the sum to be raised by the measure of the value of all the taxable property in the municipality. The *Tax Rate* is usually expressed as so many mills on each dollar of valuation or as a per cent of the valuation. The sum to be paid by each tax-payer is then computed, and an official, called the *Collector*, appointed by the Council, proceeds to receive the taxes.

Goods entering Canada from foreign countries are required to be landed at certain places called *Ports of Entry*.

The Dominion Government has a building at each port of entry, called a *Custom House*, with one or more officers attached to it, called *Custom House Officers*. These inspect the goods, examine the invoices, collect the sums levied upon the goods, etc.

An *Invoice* is a statement of the kind and quality of the goods shipped to a purchaser, with their weight or amount, and the cost of each article, made out in the currency and weights and measures of the country from which the goods are imported.

The sums collected on imported goods are called *Customs Duties*.

Certain articles, such as spirituous or malt liquors, snuff, cigars, etc., manufactured in Canada, are required to pay an *Excise Duty*. At each place where these are manufactured there are one or more government officials called *Excise Officers*, whose duty it is to check the quantities manufactured, levy the duty, see that none is disposed of without paying duty, etc.

The duty on some articles is reckoned at a certain rate per cent of their cost in the country from which they are imported. This is called an *Ad Valorem Duty*.

On other articles the duty is levied on the quantity of the goods without regard to their cost. This is called a *Specific Duty*.

On some articles both kinds of duties are levied.

ORAL EXERCISE

1. Find the tax on the following valuations:

- | | |
|-------------------------|----------------------------------|
| (a) \$2000 at 10 mills. | (d) \$4500 at 2%. |
| (b) \$1500 at 8 mills. | (e) \$8000 at $1\frac{1}{2}\%$. |
| (c) \$6000 at 1%. | (f) \$7500 at 12 mills. |

2. The rate of taxation is $1\frac{1}{2}\%$, and my property is assessed at \$4000. Find the amount of my tax.

3. If the tax rate is 15 mills on the dollar, what is the amount of a man's taxes whose property is assessed at \$6000?

4. The assessed valuation of the property of a town is \$500,000, and \$5000 is to be raised by taxation. Find the rate of taxation:

5. A man pays as a tax $1\frac{1}{4}\%$ of the value of his property, assessed at \$10,000. What is the amount of his tax?

6. If I am taxed $1\frac{1}{2}\%$ on real estate assessed at \$8000, what is the amount of my tax?

7. What is the rate of taxation expressed as a per cent , if the rate is

- (a) 15 mills on a dollar of valuation?
- (b) \$10.50 on each \$1000 of valuation?
- (c) \$2.50 on each \$100 of valuation?
- (d) 24.5 mills on each dollar of valuation?

EXERCISE

1. In a town where the assessed valuation of the property is \$1,000,000 a tax of \$25,000 is to be raised. What is the rate of taxation expressed (1) in per cent, (2) in mills on the dollar? What is the amount of J. Brown's tax on property assessed at \$7000?

2. The value of my house is \$6000, and the value of the lot is \$1200. The house is assessed at 25% of the value and the lot at 75% of its value. If the tax rate is 22 mills, find the amount of my taxes.

3. A merchant's building and lot is assessed at \$30,000 and his merchandise at \$15,000. Find the amount of his tax at 18 mills.

4. A man owns \$8500 worth of property which is assessed at 80% of its valuation. He pays a tax of \$136 on this property. Find the rate of taxation.

5. A municipality has to build three bridges each costing \$1580. The estimated expenditure for building and repairing roads is \$2010. The assessed valuation of the property in this municipality is \$1,800,000. Find the rate of taxation necessary to meet these expenditures.

6. In a rural school district the rate of taxation for school purposes is 8 cents per acre. Find the amount of the taxes, if the district is four miles by five miles, two sections being exempt from taxation.

7. The estimated expenditures of a school district for the year 1919 were as follows: Teacher's salary \$960.00, secretary-treasurer's salary \$50.00, caretaking \$60.00, repairing buildings and fence \$80.00, fuel \$96.00, debenture payment \$160.00. The district receives a government grant of \$206.00. If this district is five miles square, what will be the amount of the school tax of a farmer who owns a half section of land in the district?

8. A man receiving a salary of \$3500 pays an income tax of 2% on all over \$2000. Find the amount of his tax. Find his net income.

EXERCISE

1. If the tax in a town is \$5775 and the rate $17\frac{1}{2}$ mills on the dollar, what is the assessed valuation of the property?

2. At the rate of $15\frac{1}{4}$ mills on the dollar, what must be the assessed value of property to yield \$9150?

3. An incorporated village allows 5% for collecting its taxes. A sum of \$3610 is needed after paying the collector. This is raised by $12\frac{1}{2}$ mills on the dollar. Find the assessed value of the property.

4. A paid a tax of \$109.08. The rate of taxation was $14\frac{2}{5}$ mills on the dollar. His real property was assessed for \$4325. Find the assessed value of his personal property.

5. What is the value per acre of a half section of land on which the tax is \$64.00, if it is assessed for $\frac{5}{8}$ of its value, and the rate of taxation is 8 mills?

6. The total assessment in a town is \$750,000, and the rate of taxation is 20 mills. 10% of the taxes cannot be collected, and it costs 2% for the collection of the remainder. What are the net receipts in taxes?

7. My house valued at \$6000 is rented for \$50 a month. It is assessed for $\frac{5}{8}$ of its value, the rate of taxation being 20 mills. It costs annually \$60 to keep it in repair. Would my income be increased or decreased and by how much, if I sold the house for \$6000 and invested the money at 8%?

8. J. Brown owns property valued at \$7500. He pays annually \$120 taxes, \$50 for repairs, and \$40 for other expenses. What monthly rental must he get for his property in order to make 6% on his investment of \$7500?

EXERCISE

1. What is the duty at \$1.35 a pound on 50 cases of tobacco, each case weighing 160 pounds?

2. Find the duty on an importation of ready-made clothing invoiced for \$1750 at 35%.

3. Find the duty on 8 barrels of sugar, each weighing 800 lbs. gross, at $1\frac{3}{8}\text{¢}$ per pound, 16% being allowed for tare.

4. Find the duty on 600 cans of coffee valued at \$4.00 a can, each can containing 25 pounds, if the specific duty is 3¢ a pound and the ad valorem duty is 10%.

5. A merchant imported 50 dozen razors valued at \$15.00 a dozen. The duty was $33\frac{1}{3}\%$ ad valorem. At what price must he mark each razor to make 20%?

6. How many pounds of rice are there in a consignment valued at 4¢ per pound, on which the duty is \$48.00, made up of a specific duty of 2¢ per pound and an ad valorem duty of 10%?

7. The duty on musical instruments is 25%. For what sum must a dealer sell imported pianos on which he paid \$367.50 duty, so as to gain 20%?

8. If goods invoiced at \$875.00 cost \$1265.00 when laid down in the warehouse, the insurance and freight amounting to \$83.75, find the rate of duty.

9. R. Jones and Sons imported 600 boxes of cigars, each box containing 50 cigars and weighing $\frac{1}{2}$ pound, the invoice price per box being \$4.50. If the specific duty on cigars is \$1.75 per pound, and the ad valorem duty 25%, find the amount of duty paid on this shipment.

10. A merchant imported from Paris, France, 250 pieces of silk, each piece containing 100 yards at 5 francs per yard. He paid 35% ad valorem duty and \$60.00 for shipping charges. He retailed the silk at \$1.50 per yard. Find his gain, the franc being equivalent to 20 cents.

SIMPLE INTEREST

If a man rents a house or farm, he agrees to pay for the use of these a certain sum of money per month, or a certain sum of money per year. When a man borrows or hires money he has also to pay for its use. The money paid for the use of money is called *Interest*.

If I borrow \$500 for 1 year and agree to pay \$5.00 for the use of each \$100, I shall have to pay \$25.00 for the use of the \$500 for 1 year. \$25.00 is the interest on \$500 for 1 year.

The money for the use of which interest is paid, is called the *Principal*.

The number of dollars paid for the use of \$100 for 1 year is called the *Rate of Interest*. The rate of interest is usually expressed as a per cent of the principal for its use for 1 year. Interest at 8% means that a sum equal to 8% of the principal is to be paid each year as interest. The interest on \$500.00 for 1 year at 8% is, therefore, $\$500 \times .08$, or \$40.00.

To find the interest on any sum, at any rate per cent, for a given time.

Example:

To find the interest on \$750.00 for $2\frac{1}{2}$ years at 6%.

The interest for 1 year = $\$750 \times .06 = \$45.00$.

The interest for $2\frac{1}{2}$ years = $\$45.00 \times 2\frac{1}{2} = \$112.50$.

ORAL EXERCISE

1. What is the interest on \$100.00 for 1 year at 5%? at 7%? at 3%? at $6\frac{1}{2}$ %? at $8\frac{1}{2}$ %? at 10%?

2. What is the interest on \$300.00 for 2 years at 8%? at 6%? at $3\frac{1}{2}$ %? at $7\frac{1}{2}$ %?

3. At 4%, 6%, and 8% find the interest on:

(a) \$600.00 for 2 years. (c) \$900.00 for 3 years.

(b) \$1000.00 for 5 years. (d) \$400.00 for $1\frac{1}{2}$ years.

4. I invested \$4000 in Victory Bonds which pay $5\frac{1}{2}$ % interest. By how much is my income increased yearly through this investment?

5. Find the interest on the following sums for the times and rates specified:

(a) \$1200 for 1 yr. at 8%; for 3 yrs. at 7%; for 6 mo. at 9%; for 3 mo. at 5%.

(b) \$400 for 2 yrs. 6 mo. at 6%; for 1 yr. 3 mo. at 8%; for 9 mo. at 9%.

6. What is the amount of interest on \$250 borrowed on January 15th at 6% and paid back on September 15th of the same year?

7. What is the amount of interest on \$750 borrowed on March 10th at 8% and paid back on June 10th of the same year?

EXERCISE

Find the interest on :

1. \$550 for 2 years at 5%.
2. \$840.00 for 1 year at $6\frac{1}{2}\%$.
3. \$750 for 3 years at 8%.
4. \$3152.16 for 1 year at $7\frac{1}{2}\%$.
5. \$2838.50 for 3 years at $9\frac{1}{2}\%$.
6. \$720.00 for $3\frac{1}{2}$ years at $6\frac{1}{2}\%$.
7. \$248.50 for 5 years 6 mo. at 6%.
8. \$824.25 for 2 years 3 mo. at 8%.
9. \$1250.00 for 3 years 4 mo. at $4\frac{1}{2}\%$.
10. \$860.00 for 2 years 8 mo. at 9%.
11. \$2540.00 for 1 year 9 mo. at 4%.

12. A man borrowed \$7200.00 for 1 year, viz.: \$1250 at 7%, \$1340 at $7\frac{1}{2}\%$, \$2360 at 8%, and the remainder at $8\frac{1}{2}\%$. How much interest has he to pay at the end of the year?

13. Four brothers have to divide equally at the end of each year the interest on \$25,800 at 7%. How much does each receive each year?

14. A bank pays 3% interest on a deposit of \$6000.00. The bank loans \$4000 of this sum for 3 months at 8%; all of it for 2 months at 6%; and again \$2000 of it for 7 months at 9%. Does the bank gain or lose, and how much?

Example:

A man borrows \$500 on March 11th and agrees to pay back this money on August 15th with interest at 6%. Find the amount of interest.

Time of interest, March, 31 days—11 days, = 20 days	
April,	30 days
May,	31 days
June,	30 days
July,	31 days
August,	15 days
Total,	<u>157 days</u>

Interest for 1 year = $\$500 \times .06 = \$30.00$.

Interest for 157 days = $\frac{157}{365}$ of $\$30.00 = \$12.90$.

15. Find the interest on \$500 for 156 days at 7%.

✓ 16. Find the interest on \$7500 from May 5th to October 27th at 6%.

17. Find the interest on \$408.80 from July 3rd, 1918, to Feb. 6th, 1919 at 8%.

18. Find the interest on \$2000 at 5% from May 7th, 1917, to March 4th, 1919.

19. Find the interest on \$4500 at 8% from April 6th, 1918, to May 4th, 1919.

The sum of the principal and interest is called the *Amount*.

Example:

If a man borrows \$480.00 for 8 months at 8%, what amount should he pay back at the end of that period?

Interest on \$480.00 for 1 year = $\$480 \times .08 = \$38.40$.

Interest on \$480 for 8 mo. = $\frac{8}{12}$ of $\$38.40 = \$25.60$.

Interest = \$ 25.60

Principal = \$480.00

Amount = \$505.60

EXERCISE

1. What is the amount of \$1573 for 4 years at 5%?

2. What is the amount of \$840.00 for 10 mo. at 6%?

3. To what sum will \$784 amount in 2 years 9 mo. at 7%?
4. Find the amount of \$942.00 for 3 mo. at 8%.
5. A man borrowed \$250 on March 2nd at 7%. He paid the principal and interest on May 14th. What was the amount of principal and interest?
6. I borrowed \$500 on May 15th at 6% and \$800 on July 7th at 8%. What sum would discharge these debts on November 10th of the same year?
7. A note given on March 13th for \$820 at 5% was paid on December 20th of the same year. What amount of money was required to pay the note?
8. I have the choice of buying a house for \$4200 or of renting the same house at \$40.00 a month. Which is the better choice, if money is worth 8%, the taxes, insurance, and repairs of the house amounting to \$112 each year?

The principal, interest, and time being given, to find the rate.

Example:

At what rate per cent will \$756 yield \$241.92 interest in 4 years?

Solution. Interest on \$756 for 1 year = $\frac{1}{4}$ of \$241.92
= \$60.48

Interest on \$100 for 1 year = $\frac{\$60.48 \times 100}{756} = \$8.$

The rate = 8%.

EXERCISE

1. A man pays \$72.00 for the use of \$900 for 1 year. What is the rate of interest?
2. At what rate of interest will \$500 yield \$90 interest in 3 years?

3. The interest on \$500 for 4 years 3 mo. is \$170. Find the rate.

4. A man loaned \$484 for 5 years and received \$181.50 for the interest. What rate of interest did he charge?

5. A house costing \$7500 is rented at \$60 per month. The insurance and taxes amount yearly to \$120. What rate per cent does the money invested in the house yield?

6. A man borrowed \$2500 and agreed to pay the lender \$2600 in eight months. What rate of interest is charged?

7. The interest on \$870 for 4 yr. 6 mo. is \$274.05. What will be the interest on \$1000 for 3 mo. at the same rate?

8. Seven months after date a note for \$1800 amounted to \$1873.50. What was the rate of interest charged?

9. I deposited \$1800 in a bank, and at the end of 6 months I was credited with \$27.00 interest. What rate of interest did the bank pay?

10. I bought a quarter section of land at \$25 per acre. At the end of the year my net gains from this farm after paying all expenses were \$600. What rate of interest did the investment yield?

The principal, interest, and rate being given, to find the time.

Example:

In what time will the interest on \$600 at 5% amount to \$120?

Solution. The interest on \$600 for 1 year at 5% = \$30.00
\$30 is interest for 1 year.

\$120 is interest for $(120 \div 30)$ years = 4 years.

EXERCISE

1. In how many years will \$800 yield \$144 interest at 6%?
2. Find the time in which the interest on \$560 at $7\frac{1}{2}\%$ will be \$94.50.
3. Find the time in which \$600 will amount to \$613.75 at $5\frac{1}{2}\%$.
4. Find the time in which \$850 will amount to \$1088 at 8%.
5. A note given for \$250 at 6% remained unpaid until the interest equalled the principal. How long did the note run?
6. In how many years will any sum of money double itself at 5%? at 4%? at 8%? at 10%?
7. A sum of \$600 was loaned on June 10th, 1919, at $7\frac{1}{2}\%$. At what date did it amount to \$664?

The interest, rate, and time being given, to find the principal.

Example:

What principal will yield \$900 interest in 2 years at 6%?

For 2 years the interest is \$900.00.

\$6 is interest for 1 year on a principal of \$100.

\$12 is interest for 2 years on a principal of \$100.

\$900 is interest for 2 years on a principal of

$$\frac{\$100 \times 900}{12} = \$7500.00.$$

EXERCISE

1. What principal will yield an interest of:
 - (a) \$600 in 5 years at 6%?
 - (b) \$375 in 4 years at 5%?
 - (c) \$600 in 3 years at 8%?
 - (d) \$840 in 2 years 4 mo. at 9%?

- ✓ 2. A man borrowed money at 7% and paid \$245 interest a year. How much money did he borrow?
- ✓ 3. A man insures his life for an amount, which, invested at 6%, will give to his wife, after his death, a yearly income of \$1200. For what sum did he insure his life?
4. A man bequeathed his wife \$875.00 a year, his daughter \$770.00 a year, and his son \$630.00 a year. What sum must be invested at 7% to produce these sums?

The amount, time, and rate being given, to find the principal

Example:

What principal will amount to \$496.00 in 1 year 4 mo. at 5%?

The interest on \$100 at 5% for $1\frac{1}{3}$ yr. = $\$6\frac{2}{3}$

The principal which amounts to $\$106\frac{2}{3}$ in $1\frac{1}{3}$ yr. = \$100

The principal which amounts to \$496 in $1\frac{1}{3}$ yr. = $\frac{496 \times \$100}{106\frac{2}{3}}$
= \$465.00

EXERCISE

1. Find the principal that amounts to:

✓ (a) \$382.50 in 1 yr. at $6\frac{1}{4}\%$.

✓ (b) \$694.30 in 1 yr. 6 mo. at 4%.

✓ (c) \$772.50 in 8 mo. at $4\frac{1}{2}\%$.

✓ (d) \$1881.25 in 225 days at 5%.

2. The amount of a certain principal for $3\frac{1}{2}$ years was \$307.20, and for $3\frac{3}{4}$ years the amount was \$312.00. Find the principal and the rate.

Sometimes a purchaser buys goods, stock, land, etc., for which he gives in payment a written promise to pay at some future date, which is specified. This written promise to pay

is called a *Promissory Note*. In most cases, the person who gives the note is required to pay interest on the sum stated in the note, for the time specified in the note. Three days additional are allowed for the payment of the note, before payment can be legally enforced. These days are known as *Days of Grace*.

Example:

At a farm sale William Gorman bought from J. A. McGregor, 1 heavy wagon at \$65.00, 2 cows at \$75.00 each, and 1 team of horses at \$475.00. He gave in payment his note for 90 days dated March 10th.

Due -----	
\$ 690.00	Vancouver, B. C., March 10th, 1919.
Ninety days after date -- I -- promise to pay to the	
order of ----- J. A. McGregor ----- at the	
Union Bank, Vancouver, B. C.	
the sum of ----- Six Hundred and Ninety ----- Dollars.	
with interest at 8% per annum.	
Value received.	William Gorman

Date of note, March 10th.

Time note bears interest, 90 days and 3 days' grace.

Date when note is due is June 11th.

Rate of interest, 8% per annum.

Interest on \$690.00 for 93 days at 8% = $\frac{93}{365} \times .08 \times \$690 = \$14.06$.

Amount required to pay the note, $\$690.00 + \$14.06 = \$704.06$.

EXERCISE

1. William James bought from the Massey Harris Company, on April 3rd, farm machinery worth \$675.00. He gave in payment his note for 60 days, bearing interest at 9%. What amount will he have to pay when the note is due? On what date is the note due?

2. A farmer bought 6 head of steers at \$65.00 each and 18 sheep at \$15.00 each at a farm sale on September 6th. He gave in payment his note drawn for 3 months, bearing interest at 7%. Find the date when the note is due. What amount will he have to pay when the note is due?

3. William Stewart bought from the John Deere Plough Company, on February 25th, farm machinery worth \$625.00. He gave in payment his note drawn for 8 months and bearing interest at 9% per annum. Find the date when this note is due. What amount will William Stewart have to pay when the note is due?

4.

\$ 395.00

Nelson, B. C. August 3rd, 1918.

Four months after date... I... promise to pay to the order of the... International Harvester Company... at the

Royal Bank of Canada

NELSON

the sum of... Three Hundred and Ninety-five... Dollars with interest at 9% per annum.

Value received.

George Ross

(1) Find when this note is due. (2) What amount will George Ross have to pay when the note is due?

5.

\$ 720.00	Kamloops, B. C., May 4th, 1918
Six months after date I promise to pay to the	
Cockshutt Company at the Dominion Bank, Kamloops	
the sum of Seven Hundred and Twenty Dollars	
with interest at 8% per annum.	
Value received.	William Robertson

Find when this note is due. (2) What amount will William Robertson have to pay when the note is due?

EXERCISE

1. Find the interest on \$275.60 from 18th July, 1911, to 13th September, 1912, at 6% per annum.

2. Find the interest on \$84.25 from April 16th, 1908, to November 4th, 1909, at 7% per annum (year = 365 days).

3. A person borrows money for 6 yr. at $3\frac{1}{2}\%$ and repays at the end of the time as principal and interest, \$847. How much did he borrow?

4. Find the interest on \$387.56 from March 18th to November 19th at 6% per annum.

5. A note of \$360, drawn April 20th, 1911, is paid July 2nd, 1912, with interest at $7\frac{1}{2}\%$ per annum. Find the amount paid.

6. On June 29th, 1909, I borrowed \$16.50, with interest at $6\frac{1}{2}\%$, and returned it on April 30th, 1910. What amount did I then pay?

7. I bought a horse for \$160 and gave in payment my note dated August 15th, 1911, with interest at $7\frac{1}{2}\%$ per annum until paid. On January 8th, 1912, I sold the horse for \$200 cash and paid my note. What was my net gain?

8. What amount will be due July 1st, 1911, on a note of \$80, drawn February 6th, 1911, and bearing interest at $5\frac{1}{4}\%$ per annum?

9. On October 15th, 1911, a young man deposited in a savings bank the sum of \$860.75. On May 20th, 1912, he withdrew the principal and simple interest at 4% per annum. What amount did he withdraw?

10. On January 1st, 1910, A borrowed \$1000 from B at 6% per annum. On July 1st, 1911, he paid the interest to date and \$510. How much did A owe B on January 1st, 1914, when he paid the debt, principal and interest?

EXERCISE

1. On May 15th, 1908, a man bought a piano for \$500, agreeing to pay \$125 a year at the end of each year until it was paid for, with interest at 6% per annum.

- (a) Find the dates on which the various payments were due.
- (b) Calculate the amount of each payment.
- (c) When the piano was finally paid for, how much did it cost him?

2. A man borrowed \$1400 from a loan company on Feb. 1st, 1914, agreeing to repay the principal at the rate of \$140.00 at the end of each year, with interest at 8%.

- (a) How many years will it take to repay the loan?
- (b) Calculate the amount of each payment.
- (c) Find the total amount of interest he has paid during the period.

3. A school district on April 1st, 1912, borrowed \$1200 to defray the expenses of building and equipping a school, agreeing to repay the principal in ten equal annual payments at $5\frac{1}{2}\%$.

- (a) On what dates are the various payments due?
- (b) Calculate the amount of each payment.
- (c) Find the total amount of interest paid during the period.

4. A school district borrowed \$1200, the principal to be repaid in 8 equal annual payments with interest at 6%.

- (a) Find the amount of each payment.
- (b) Find the total amount of interest paid.

5. A school district in Saskatchewan borrowed \$1000, on April 1st, 1913, agreeing to repay it in ten equal annual payments with interest at 6%.

- (a) Make a table showing the dates of payment, principal, interest, and amount due on each date.
- (b) Find the total amount paid during the period.

6. Make a similar table in the case of a loan of \$12,000, made on March 15th, 1913, payable in 15 equal annual payments, interest at 6%.

7. A school board in British Columbia received notice on March 1st, 1913, from a Loan Company, that the last payment of principal and interest on the loan of \$1000 to that district would be due on April 15th. If the loan was repayable in 10 equal annual payments with interest at 6%, find :

(a) The date on which the loan was made.

(b) The amount of the payment due.

BANKING

To facilitate the transaction of business, there are institutions called *Banks*, which deal in money and credit. They receive money from persons who wish to deposit it where it will be safe and can be obtained when it is needed. If it is the intention of the person not to use the money for a considerable time, it is desirable to deposit it in the *Savings Branch* of the bank, for the bank will pay interest upon sums of money deposited in the savings branch. The interest is usually added to the sum on deposit at the end of each half year. If the money is deposited for safe keeping and also for convenience in doing business, it is placed in a *Current Account*. No interest is paid on money thus deposited. *Cheques* may be drawn against this account. A person is able to make payments by issuing cheques against this account in place of paying with cash.

Some business institutions require all cheques received as payment of an account to be certified by the bank on which the cheque is drawn. This is done by the proper official of the bank stamping the word "accepted" across the face of the cheque, and a sufficient sum is set aside from the account of the man issuing the cheque to insure payment.

Besides the receiving of deposits of money for safe keeping, the banks have other important business to perform. They loan money on good security to business men and others, and also remit money from one place to another for their customers.

In opening an account at a bank, the person fills out a *Deposit Slip* as shown on this page. On this slip the number

THE BANK OF TORONTO CREDIT			
OF		192	
x	1=		
x	2=		
x	5=		
x	10=		
x	20=		
x	50=		
x	100=		
Silver.....			
Gold.....			
Cheques.....			

DEPOSIT SLIP

of bills of each denomination, the cheques, the silver, etc., to be deposited must be indicated. Occasionally the bank requires references as to a person's reliability and always requires his "legal signature" as a matter of reference. The person receives a pass book in which is entered by the receiving teller, the amount of money left on deposit. When further deposits are made, the pass book is presented each time for the receiving teller to enter in the amount deposited. At the end of each month the pass book is left at the bank for the clerks to enter in it the account of all

cheques paid by the bank for the person, and to calculate the balance of the person's account. The cancelled cheques the bank has cashed are returned to the person. These cheques serve as vouchers or receipts for payments made.

BANK CHEQUE

	No. _____	$\frac{4}{10}$
	<i>Calgary</i> _____ 19____ ALBERTA	
The Bank of Toronto		
Pay to _____		or Order
		_____ ⁰⁰ / ₁₀₀ Dollars
\$ _____ _____		

EXERCISE

1. A customer enters a bank to deposit 8 one-dollar bills, 5 twos, 7 fives, 2 twenties, three cheques for \$24.85, \$32.85, and \$41, and \$8.37 in change. Fill in his deposit slip.

2. David Smith owes Thompson & Co. \$247.89 for work done. Smith draws a cheque on the Imperial Bank for this sum. Write out the cheque, supplying name of place and date.

3. A farmer having \$258.16 to his credit in a bank on April 30th, deposits \$17.36, \$24.84, \$72.96, and \$36.45 during the month of May, and draws cheques for \$8.75, \$21, \$36.19, and \$11.37. Find his balance on May 31st.

4. Make out a deposit slip for the following : 25 one-dollar bills, 17 twos, 18 fives, 2 fifties, cheques for \$42.50, \$36.85, \$17.28, \$47.50, and silver \$14.25.

5. John Morrison owes the Massey-Harris Company \$275 on account. He draws his cheque on the Bank of Nova Scotia, on May 8th, 1920 for this sum. Write the cheque.

6. A merchant's deposits during the week have been \$125.32, \$117.84, \$203.16, \$175.15, \$204.15, and \$184.25. He has given cheques for \$46.75, \$24.84, \$36.15, and \$29.40. At the beginning of the week his bank balance was overdrawn \$24.36. Find his balance at the end of the week.

7. Draw a cheque on the Union Bank of Canada at Vancouver, B. C., for the payment of one month's rent in advance on your house in favor of the owner (name to be supplied). Your rental is \$45.00 per month. Use present date.

8. A cheque drawn on the Canadian Bank of Commerce, Calgary, Alberta, for \$95.00, made by J. W. Brown to your order is received by you. You wish to transfer this cheque to W. Smith as payment of account. Write the cheque and make the proper endorsement upon it, so that it may be cashed when presented to the bank by W. Smith.

9. You wish to draw out \$25 from the Imperial Bank of Canada for personal use. Write the cheque, using the present date.

COMPOUND INTEREST

When the amount of interest on a sum of money accumulated at the end of any interest period is added to the sum, and for the next interest period with the original sum draws interest, the investor is said to receive *Compound Interest*. In a savings bank the interest is credited to a person's account every six months, and thus the banks pay compound interest on deposits in the savings branch.

Example :

A man deposited \$2500 with a Trust Company, the interest being added to the principal every 6 months at 4% per

annum. What will be the amount on deposit to his credit at the end of 18 months?

Original deposit	\$2500
Interest for 1st 6 mo.	<u>50</u>
Amount on deposit for 2nd 6 mo.	\$2550
Interest for 2nd 6 mo.	<u>51</u>
Amount on deposit for 3rd 6 mo.	\$2601
Interest for 3rd 6 mo.	<u>52.02</u>
Sum at his credit at the end of 18 months is . . .	\$2653.02

The compound interest on \$2500 for 18 mo. at 4% per annum compounded half yearly is $\$50 + \$51 + \$52.02 = \$153.02$.

EXERCISE

Find the compound interest and the amount of:

1. \$1000 for 2 yr. at 5%, compounded annually.
2. \$2500 for 3 yr. at 6%, compounded annually.
3. \$2500 for $1\frac{1}{2}$ yr. at 8%, compounded half-yearly.

Find the difference between the simple and the compound interest on the following:

4. \$1000 for 3 yr., at 6% compounded annually.
5. \$2500 for 18 mo., at 4% compounded half-yearly.
6. \$2500 for 1 yr., at 8% compounded quarterly.
7. What is the compound interest on \$650 for 3 years at 6 per cent, interest being compounded annually?
8. Find the difference between the simple and the compound interest on \$350 for 3 years at 8 per cent, interest being compounded annually.
9. A sum of money put out at simple interest for 2 years at 8 per cent amounted to \$464; to what sum would it have amounted had it been loaned at compound interest?

10. The simple interest on a sum of money for 3 years at 8 per cent is \$120; what is the compound interest compounded yearly on the same sum for the same time?

11. A man deposits in the savings bank \$500, on which interest at 4 per cent per annum is to be added to the principal every 6 months. How much money has the man in the bank at the end of two years?

12. A father placed \$100 in the savings bank in his boy's name, when the boy was 8 years old. Each half year the bank added interest at the rate of 4% per annum to the deposit, and the father added \$50 every year. What will be the amount on deposit to the boy's credit when he is ten years old?

BANK DISCOUNT

A great part of the money used in business is borrowed money. This borrowed money is usually obtained from banks.

\$ 1000.00

Due _____

Edmonton, Alta., October 5th, 1919

-----Sixty days-----after date---I---promise to pay to

the order of -----Union Bank of Canada-----at the

-----Union Bank of Canada, Edmonton, Alta.-----

the sum of One Thousand ----- $\frac{00}{100}$ Dollars

with interest at the rate of --8-- per cent per annum until

due and --8-- per cent per annum after due until paid,

value received.

No. _____

James Williams

208 Robert Street

A merchant wishes to obtain a loan of \$1000 for 60 days from the bank with which he has been doing business. The manager or accountant makes out a note in the form given, and the merchant signs it. The bank deducts the interest in advance on \$1000 for 63 days at a certain rate per cent, gives the merchant the balance, and collects the \$1000 from the merchant at the end of the 63 days.

Note. — The three days added to the specified time are called *Days of Grace* which must elapse before payment of the note can be legally enforced.

To make the payment of the note more secure, the banker often requires the signature of another person or persons known as indorser or indorsers, or requires the conveyance of real or personal property to the bank as security for the payment of the note.

The interest in advance deducted by the bank from the amount of the note at maturity is called *Bank Discount*. When a man borrows from a bank, he pays this interest in advance.

The difference between the sum on a note at its maturity and the discount is called the *Proceeds*.

The sum for which the note is drawn is called the *Face of the Note*.

The number of days from the time when a note is discounted to the time when it legally matures is called the *Term of Discount*.

A bank not only discounts notes made by its customers direct to the bank, but it also discounts notes owned by its customers and payable to them. The owner of the note indorses the note, making it payable to the bank. These notes may or may not bear interest.

FORM OF NOTE NOT BEARING INTEREST

<i>\$ 300.00</i>	<i>Due</i> _____
<i>Regina, Sask., May 27th, 1919</i>	
<i>Three months after date I promise to pay to the order of</i> <i>William Robinson</i> _____ <i>at the</i>	
Canadian Bank of Commerce REGINA	
<i>the sum of Three Hundred</i> _____ <i>⁰⁰/₁₀₀ Dollars</i> <i>for value received.</i>	
<i>No.</i> _____	<i>James Thompson.</i>

This note is discounted at the Canadian Bank of Commerce, Regina, on June 30th, at 8%.

What is the face of this note?

When did this note become legally due?

What is the term of discount?

What is the discount?

What are the proceeds?

The number of days from June 30th to August 30th is 61 ; therefore, the term of discount is 61 days.

The face of the note is \$300, and the value of the note at maturity is also \$300.

The interest on \$300 for 61 days at 8% is \$4.01. The discount is \$4.01.

The proceeds are $\$300.00 - \$4.01 = \$295.99$.

EXERCISE

Find (1) the date of maturity, (2) the term of discount, (3) the discount, (4) the proceeds of the following notes :

	DATE OF NOTE	FACE OF NOTE	TIME	DATE OF DISCOUNT	RATE
1.	April 21st, 1919	\$500	3 mo.	May 5th	6%
2.	Sept. 15th, 1919	\$400	4 mo.	Sept. 15th	7%
✓ 3.	Jan. 25th, 1919	\$657	60 days	Feb. 14th	8%
4.	May 11th, 1919	\$511	6 mo.	July 31st	6%

5. Write a 90-day note payable by you to some member of your class, at a local bank.

6. I can borrow \$800 on a 60-day note at 8% from a person or from a bank. How does the interest in the one case compare with the discount in the other? What is the advantage of borrowing from the person? If I borrow from the bank, what rate of interest do I actually pay?

7. A note for \$750.00 without interest, due Sept. 15th, is discounted at 6% on June 28. What are the proceeds?

8. I bought a lot for \$1200 cash and sold it at an advance of $12\frac{1}{2}\%$ on a 90-day note not bearing interest, which I immediately discounted at the bank at 8%. How much did I make?

9. What is the bank discount and net proceeds of a note for \$584 drawn Jan. 8th, 1918, for 10 months, and discounted at the bank on June 6th, at 6%?

10. A 3-months note for \$900 was dated April 8th and discounted May 27th at 8%. Find the proceeds.

FORM OF NOTE BEARING INTEREST

$\\$ 200 \frac{00}{100}$	Due _____
<i>Vancouver, B. C., April 15th, 1919</i>	
<i>Sixty days after date I promise to pay to the order of</i> <i>James Ross _____ at the</i>	
Bank of Montreal Vancouver, B.C.	
<i>the sum of Two Hundred</i> _____ $\frac{00}{100}$ <i>Dollars</i> <i>for value received, with interest at the rate of 5 per cent per annum.</i>	
<i>No.</i> _____	<i>Robert Turner.</i>

This note is discounted May 10th at the Bank of Montreal, Vancouver, at 6%.

The date of maturity is June 17th.

The amount or value of the note at maturity will be \$200 + interest on \$200 for 63 days at 5%, which is \$201.73.

The term of discount is the number of days between May 10 and June 17, or 38 days.

The discount on \$201.73 for 38 days at 6% is \$1.26.

The proceeds of the note are \$201.73 - \$1.26 or \$200.47.

EXERCISE

Find the discount and proceeds of each of the following interest bearing notes :

	FACE OF NOTE	DATE	TIME	RATE OF INTEREST	DATE OF DISCOUNT	RATE OF DISCOUNT
1.	\$400	Sept. 10th	90 da.	6%	Nov. 15th	8%
2.	\$250	June 15th	60 da.	5%	July 4th	7%

FACE OF NOTE	DATE	TIME	RATE OF INTEREST	DATE OF DISCOUNT	RATE OF DISCOUNT
3. \$750	Mar. 21st	2 mo.	7%	April 10th	8%
4. \$1000	July 11th	3 mo.	4%	Aug. 15th	6%
5. \$1200	June 12th	4 mo.	6%	June 12th	8%

Write out the above notes supplying the name of the maker of the note, the name of the person to whom the money has to be paid, the name of the place, and the name of the bank.

6. I bought a quarter section of land for \$25 per acre and on April 8th sold it for \$30 per acre, receiving one-third cash and a six-months note bearing interest at 6% as payment for the balance. I immediately had the note discounted at the bank at 8%. How much did I make out of this investment?

7. A farmer purchases a tractor from the J. I. Case Co., on March 10th, 1919, for \$1200. He paid one-half cash and gave a nine-months note for the balance, bearing interest at 6%. When does this note mature? Find the amount of the note at the date of maturity. How much money does the farmer actually pay for the tractor? If the J. I. Case Co. have this note discounted at the bank on July 20th at 8%, how much money does the company actually receive for the tractor?

Write the above note, supplying the name of the farmer and the name of the bank.

8. Find the face of a 70-day note that discounted at 8% on the day it is made will realize \$787.20 in cash.

9. I bought a team of horses for \$490. To get money to pay for this team I had a 143-day note discounted at the bank at 5%. For what sum was this note drawn?

10. A banker charged me \$30 discount on a note of \$1200 due in 40 days. Find the rate of discount charged.

11. A banker discounts a note of \$250 at 10% and charges \$10 discount. For how long was the discount computed?

12. I bought goods from a wholesale house at the listed price of \$1600, less discounts of 10% and 5%. As payment for the goods, the wholesaler took my 70-day note for an amount such that when it was discounted immediately at 8%, the proceeds paid the bill. What was the face of the note?

13. A hardware merchant sold a farmer \$420 worth of hardware and took in payment the farmer's 90-day note, bearing interest at 6%. Fifteen days later the merchant had this note discounted at his bank at 8%. Find the proceeds of the note.

14. A flour and feed merchant bought \$2400 worth of flour, the freight and cartage amounting to \$100. He sold the flour at an advance of 20% on the total cost, and as payment took a note for 90 days without interest. He immediately discounted this note at 6%. What was his profit?

DRAFTS

James McGuire, a hardware merchant in Edmonton, owes Brown & Co., a wholesale firm in Winnipeg, \$1000. In payment of this account the actual money is not transmitted to Winnipeg, nor is the payment usually made by cheque. The common method of paying a debt in a distant place is by means of the *Bank Draft*. The merchant in Edmonton goes to his bank and purchases a draft of the following form:

\$ 1000

No. 1350

The Canadian Bank of Commerce

Edmonton, Oct. 14, 1919

Pay Brown & Co., Winnipeg _____ or order

One Thousand _____ $\frac{00}{100}$ DollarsTo CANADIAN BANK OF COMMERCE,
WINNIPEG, MAN.R. Jones, Manager
J. Dunlop, Accountant

This draft is sent to Brown & Co., Winnipeg, who present it at the Bank of Commerce, Winnipeg, for payment.

The banks charge their customers for these drafts. The charge is known in business as *Exchange*, and is reckoned as a small percentage of the face of the draft. If the bank charged $\frac{1}{4}\%$ exchange, it would cost James McGuire \$2.50 to make the remittance to Winnipeg.

Suppose a merchant doing business in Vancouver owes a firm in Montreal for merchandise. It is usual for the latter to draw on the former, that is they instruct the Vancouver merchant to pay the sum covering the account into a bank in Vancouver, which bank remits it to the firm's bank in Montreal. In cases of this kind a draft of the form on page 162 is generally used.

A small charge is made for the collection of this account by the bank.

If the Vancouver merchant intends to pay the draft when presented to him, he writes the word "accepted" across the face of the draft, the date of acceptance, and his signature. The draft has now the same legal value as a promissory note.

SIGHT AND TIME DRAFT

<i>No.</i> _____ <i>\$ 400.00</i>	<i>Due</i> _____ <i>Montreal, Que., June 14, 1919</i>
<i>-----Thirty days-----after date pay to the order of</i> The Standard Bank of Canada	
<i>Four Hundred</i> _____ <i>⁰⁰/₁₀₀ Dollars</i>	
<i>Value received and charge to the account of</i>	
To J. A. BROWN, } VANCOUVER, B. C. {	<i>William Ross & Co.</i> <i>Montreal, P. Q.</i>

A time draft has the same form as the sight draft. If the draft were to be paid 30 days after the date on which it was presented, the words "30 days after date" would replace the words "at sight" on the sight draft.

EXERCISE

1. You owe J. Saunders, Toronto, a debt of \$750 and remit this amount by means of a draft bought at your bank. Write out this draft supplying the name of a bank. What would the exchange amount to at $\frac{1}{2}\%$?

2. John Brown, of Yarmouth, owes Rutherford & Co., of Truro, \$1500. Rutherford & Co. draw on Brown through the Bank of Nova Scotia. Write out the draft.

REVIEW EXERCISE

1. A man owning $\frac{7}{10}$ of a store sold 45% of his share for \$6930. What part of the whole store did he sell? What was the value of the store?

2. A merchant placed 75% of his year's profits in a bank. Later he drew out 25% of this deposit, and his bank account still showed a deposit of \$2700. What were his profits for the year?

3. A speculator invested $62\frac{1}{2}\%$ of his estate in a mine and deposited the remainder, \$5400, in the bank. Find the value of his estate. How much did he invest in the mine?

4. A bill of goods on which a discount of 8% was allowed was settled for \$414. Find the amount of the bill.

5. Write a note for the following: I borrow of Fred Thomas \$640, payable in 4 mo. at 8% .

6. When the rate of taxation is reduced from $18\frac{1}{2}$ mills on the dollar to $16\frac{1}{4}$ mills, my taxes are reduced \$9. Find the amount of my assessment.

7. What sum must be paid to discharge a debt of \$1800 due 15 mo. hence and bearing interest at 8% per annum?

8. A dealer sold two motor cars for \$1800 each. On one he lost 25% , and on the other he gained 25% . Did he gain or lose on the sale of the two cars, and how much?

9. A man's barn was damaged by fire to the extent of 40% of its value. He received from the insurance company in which the barn was insured the sum of \$972. What was the value of the barn?

10. A clerk whose salary was increased 20% is now receiving a salary of \$1800. What was his former salary?

REVIEW EXERCISE

1. In a town the rate of taxation is 15 mills on the dollar. The assessment is 75% of the real value of the property in the town. What tax does a man pay who owns property in the town valued at \$6400?

2. A tax of \$2,000,000 is raised in a city upon an assessment of \$125,000,000. What is the rate of taxation? Find the amount of taxes paid by the owner of property assessed at \$19,700.

3. A merchant's sales for the year amounted to \$31,378. This amount was $8\frac{1}{5}\%$ more than his sales last year. What was the amount of his sales last year?

4. What single discount is equivalent to 25% and 10% off?

5. An agent sold \$15,800 worth of goods, and his commission amounted to \$395. What rate of commission did he charge?

6. On July 10th, 1919, James Ross of Fredericton bought three teams of horses from Frank Bishop for \$1500. He paid \$900 cash and gave his 60-day note for the balance. The same day Bishop discounted the note at 8%. (a) Write the note. (b) Find the proceeds of the note. How much money did Bishop receive for the teams?

7. A house that cost \$8000 rents for \$60 per month. It is insured for 75% of its value, the rate being 2% for three years' protection. The taxes are 20 mills on the dollar on an assessment of \$5400. Repairs, etc. during the year amounted to \$32. What rate of interest does this house pay on the investment of \$8000?

8. James Brown in the employ of Kent's Real Estate Agency sold for his firm a house and lot for \$12,500. The firm received a commission of \$625 and out of this commission gave Brown \$250. What rate of commission did the firm charge? On what rate of commission is Brown working?

9. The assessed valuation of the property of a village is \$840,000. The estimated expenditures for the year include \$5400 for schools, \$4830 for public works, \$3000 for salaries of officials, and \$210 for other expenditures. What rate of taxation must be levied to meet these expenditures?

10. A horse dealer bought 25 horses at \$120 per head. He sold 8 of them at \$135 per head, 10 of them at \$140 per head, and the remainder at \$145 per head. His expenses in connection with the buying and selling of these horses amounted to \$4.20 per head. What was his per cent profit?

REVIEW EXERCISE

1. My property was assessed at \$4800, the rate of taxation being 22 mills. I received a discount of 5% for prompt payment. What amount of taxes did I pay?

2. A farmer sells a carload of wheat containing 2000 bushels at \$1.80 per bu. If he had kept his wheat one month longer, he would have received 10¢ per bu. more for it. Reckoning interest at 8%, find how much he would have gained by holding his wheat and selling it at the increased market price.

3. Investigations made in a certain district in Manitoba showed that there was a loss of 20% in the oat crop due to smut. What was the loss to the farmer who harvested 40 bu. to the acre from an 80-acre field, the market price of oats being 75¢ per bu.?

4. A merchant's balance in the bank at the beginning of the week was \$1675.50. During the week he deposited \$327.75, \$263.40, \$415.25, \$200, \$164.80, and \$380.20. He paid by cheque a bill of goods for \$876 less 5% discount, another bill for \$350 less 2% discount, \$185 for wages, and \$275 for store rent. Find his bank balance at the end of the week.

5. A boy deposited in the savings bank \$150 on Jan. 1st, 1917. The bank pays interest at 4% per annum, the interest being added half yearly to the amount on deposit on Jan. 1st and July 1st. On July 2nd, 1918, the boy withdraws from the bank enough money to pay for a bicycle costing \$60, a suit of clothes costing \$25, and a rifle costing \$32. How much money is there still in the bank to the boy's credit?

6. A farmer bought 20 head of cattle for \$900 and kept them one year. During that time he fed them per head, $1\frac{1}{4}$ ton of hay valued at \$16 per ton, 50 bu. of chop valued at 72¢ per bushel, and 1.5 tons of silage valued at \$8.00 per ton. At what price per head must he sell them to realize a profit of 20% on his investment?

7. If wheat loses 20% by weight when ground into flour, how many bushels of wheat are required to make a barrel of flour?

8. An agent collected 75% of a doubtful account and received \$12 for making the collection. If the rate of commission he charges is 5%, find the amount of the account.

9. A merchant failed in business with liabilities amounting to \$30,000. His assets were: merchandise valued at \$10,000, accounts receivable \$3000, and property (real estate) valued at \$3500. How many cents on the dollar will his creditors receive?

10. What per cent does a man make on his money who rents a house that cost him \$7200 for \$600 per year?

REVIEW EXERCISE

1. A marine insurance company received \$540 for insuring a vessel worth \$90,000 at $\frac{2}{3}$ of its value. What rate of insurance did the company charge?

2. A man, having a family of four children all under the age of 16 years, receives a salary of \$3500. Of this salary \$2000 is exempt from the Federal income tax, and in addition \$200 for each child under 16 years is exempt. Find the amount of Federal income tax this man pays, the rate being 5%.

3. An insurance company, having insured a block for \$200,000 at 75¢ per \$100, reinsured \$50,000 of this risk with another company at $\frac{3}{8}\%$, and \$90,000 with another company at $\frac{3}{8}\%$. What amount of premium did this company receive more than it paid out?

4. A grocer buys 50 barrels of apples, each containing $2\frac{1}{2}$ bushels, at \$4.40 per barrel. If the loss by decay amounts to 20%, at what price per bushel must he sell the remainder to make a profit of $12\frac{1}{2}\%$?

5. A dealer marked the selling price of his goods 25% above the cost. What per cent of their cost would he gain or lose, if he sold them at a special sale 25% below the marked price?

6. A shipment of glassware was invoiced at \$1200 with discounts of 20% and 10% off. For what price must this shipment be sold to yield a net profit of 25%?

7. Write a note in which you promise to pay William Grant \$600 in 3 months with interest at 8%.

8. I sell to a customer a bill of goods amounting to \$250. I am willing to take his 70-day note for this amount, which I will immediately discount at the bank at 8%, or I will give him a discount of 2% for cash. Which is the better settlement from my standpoint?

9. A man pays an annual premium of \$35.60 a thousand on a life insurance policy. If the total annual premium is \$178, what is the face of the policy?

10. A manufacturer sells coal ranges to a hardware merchant at such a price that the hardware merchant can sell them at \$60 each and make a profit of 25%. The manufacturer makes a profit of $33\frac{1}{3}\%$. Find the cost of manufacture per range.

CHAPTER VI

POWERS AND ROOTS

Powers

Introductory.

1. What is the product of 2×2 ?
2. What is the product of $2 \times 2 \times 2$?
3. What is the product when 2 is used as a factor 4 times? 5 times?
4. What is the product when 3 is used as a factor twice? 3 times? 4 times?

The product obtained by using the same number two or more times as a factor is called a *Power* of the number.

4, 8, 16, 32, etc. are powers of 2. 9, 27, 81 are powers of 3.
16, 64, 256, etc. are powers of 4. 49 is a power of 7.

The power is known by the number of times the given number is used as a factor. If the number is used *twice* as a factor, the product is the *Square* or the *Second Power* of the number.

4 is the square or second power of 2.

81 is the square or second power of 9.

If the number is used 3 times as a factor, the product is the *Cube* or the *Third Power* of the number.

27 is the cube or third power of 3.

125 is the cube or third power of 5.

If the number is used 4 times as a factor, the product is the *Fourth Power* of the number ; if used 5 times the product is the *Fifth Power*, etc.

EXERCISE

1. Find the square or the second power of the following numbers: 6, 8, 11, 25, 9, 17, 50, 40.

2. Find the cube or the third power of the following numbers: 4, 7, 8, 9, 10, 50.

3. Find the fourth power of 3, 5, 10, 20.

The number of times a number is used as a factor to produce a power is indicated by a figure placed at the right of and a little above the number. This is called the *Exponent* or *Index*.

Examples:

49 is 7^2 . 125 is 5^3 . 64 is 2^6 .

In these examples 2, 3, and 6 are exponents or indices.

The expressions 7^2 , 5^3 , 2^6 are read 7 squared, 5 cubed; and 2 to the sixth power.

EXERCISE

1. Read the following expressions and give the value of each:

1^2 , 2^2 , 3^2 , 4^2 , 5^2 , 6^2 , 7^2 , 8^2 , 9^2 , 10^2 , 11^2 , 12^2 .

2. Read the following expressions and find the value of each:

1^3 , 2^3 , 3^3 , 4^3 , 5^3 , 6^3 , 7^3 , 8^3 , 9^3 , 10^3 , 11^3 , 12^3 .

3. Find the square or second power of the following numbers:

<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>	<i>f</i>	<i>g</i>	<i>h</i>	<i>i</i>	<i>j</i>	<i>k</i>
15	35	27	19	57	49	75	3.5	7.8	9.5	6.52

4. Find the cube or the third power of the following:

<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>	<i>f</i>	<i>g</i>	<i>h</i>	<i>i</i>	<i>j</i>	<i>k</i>
9	17	25	50	100	3.2	4.5	.05	3.05	.002	7.003

In order to find the power of a fraction we reduce the fraction to its lowest terms and find the power of the numerator and the denominator.

Example:

Find the square of $\frac{12}{15}$.

Reduce the fraction to its lowest terms by dividing the numerator and denominator by 3. We have $\frac{4}{5}$.

To find the square of $\frac{4}{5}$, find the square of the numerator and denominator, *i.e.* $\frac{16}{25}$.

In the same way to find the third or fourth powers of a fraction, find the third and fourth powers of each of the terms of the fraction.

The cube of $\frac{2}{3}$ is $\frac{8}{27}$.

The fourth power of $\frac{1}{2}$ is $\frac{1}{16}$.

EXERCISE

1. Find the square of the following:

$$\frac{1}{2}, \frac{3}{4}, \frac{5}{6}, \frac{7}{8}, \frac{2}{9}, \frac{9}{12}, \frac{35}{42}.$$

2. Find the cube or the third power of the following:

$$\frac{2}{3}, \frac{6}{15}, \frac{3}{9}, \frac{14}{35}.$$

3. Find the fourth power of the following:

$$\frac{1}{3}, \frac{1}{5}, \frac{2}{7}, \frac{3}{8}.$$

EXERCISE

Find the value of the following:

- | | | | |
|------------------------|------------------------|-----------------------|------------------------|
| 1. $4^3 \times 5^2$ | 2. $5^3 \times 3^2$ | 3. $25^2 \times 10^3$ | 4. $4^3 \times 6^2$ |
| 5. $9^2 \times 3^3$ | 6. $15^3 \div 5^2$ | 7. $12^2 \div 6^3$ | 8. $(1.7)^3 \div 17^3$ |
| 9. $37^2 \div (3.7)^2$ | 10. $(2\frac{1}{3})^2$ | | |

EXERCISE

1. Write the squares of the numbers from 13 to 20 inclusive.

2. Find the cubes of the odd numbers from 7 to 15 inclusive.

3. What power of a number is obtained by multiplying together the first power, the third power, and the fifth power? Prove by using 2 as the number.

4. When the second power of a number is multiplied by its third power and then by its fifth power, what is the power of the product? Prove your answer by using 3 as the number.

5. Of what number is 509 one of the two equal factors?

6. Of what number is 3007 one of the two equal factors?

7. Find the number of which one of the three equal factors is 0.7.

8. Find the number of which one of the four equal factors is 0.3.

9. A rectangular field is 54 rods long and 36 rods wide. Find the area of a square field which has the same perimeter as this field.

10. When the seventh power of a number is divided by its fourth power, what power of that number is the quotient? Prove your answer by using the number 2.

Square Root

Introductory.

1. What is the *second power* of 5? of 9? of 12?

2. What number multiplied by itself will give as product :
36? 81? 25? 64? 121?

3. Find the number whose *second power* is 16? 49?
144? 169?

4. Find the *two equal factors* of each of the following :
9, 25, 49, 225, 100.

One of the two equal factors of a number is called the square root of the number.

4 is the square root of 16 ; 9 is the square root of 81.

The *Square Root* of a number is indicated by the sign $\sqrt{\quad}$, placed over the number, the square root of which is to be found.

Example: $\sqrt{64}$ means the square root of 64.

EXERCISE

1. What is the square root of each of the following :
144? 625? 169? 121? 64?
2. Square any whole number or integer of one digit. Examine the product and find the number of figures or digits in the square of a number of one digit.
3. Square several numbers of two digits. Examine the product and find the number of figures or digits in the square of a number of two digits.
4. Square several numbers of three digits. Examine the product and find the number of figures or digits in the square of a number of three digits.
5. The square of a number is 82,369. How many figures or digits are there in the number?
6. How many digits or figures are there in the square root of each of the following numbers :
841? 2304? 9801? 88,804? 6889? 776,161?

7. How many figures are there in the square root of the following numbers :

- a. a number of 3 digits?
- b. a number of 6 digits?
- c. a number of 7 digits?
- d. a number of 4 digits?

8. There are 3 figures in the square root of a number. How many figures are there in the number?

9. There are 4 figures in the square root of a number. How many figures are there in the number?

10. Make a general rule showing the relation between the number of figures in any number and the number of figures in its square root.

Rule. — The number of figures or digits in the square root of a number is the same as the number of periods of two figures or digits, into which the number can be separated, beginning with the units and marking off periods of two digits each to the left. The last place or period on the left may contain only one figure or digit.

To find the square root of a number by factoring :

Examples: $6 \times 6 = 36$. Then $\sqrt{36} = \sqrt{6 \times 6} = 6$.

Find by factoring, the square root of 400.

The prime factors of 400 are $2 \times 2 \times 2 \times 2 \times 5 \times 5$.

We arrange these in two groups with the same factors in each group, thus: $(2 \times 2 \times 5) \times (2 \times 2 \times 5)$.

Hence the square root of 400 is the same as the square root of $(2 \times 2 \times 5) \times (2 \times 2 \times 5)$ which is $2 \times 2 \times 5$, or 20.

$$\sqrt{400} = 20.$$

EXERCISE

Find by factoring, the square root of the following :

<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>	<i>f</i>	<i>g</i>	<i>h</i>	<i>i</i>	<i>j</i>
1. 100	81	225	729	361	289	576	625	1296	441

To find the square root of a number.

Introductory.

1. Examine the following method of finding the square or second power of 25.

$$\begin{aligned}
 25 &= 20 + 5 \\
 25 &= \frac{20 + 5}{125} = \frac{20 \times 5 + 5^2}{500} = \frac{20^2 + 20 \times 5}{625} = \frac{20^2 + 2 \times 20 \times 5 + 5^2}{= 20^2 + (2 \times 20 + 5) \times 5}
 \end{aligned}$$

2. Find the square of 43 in a similar way and examine the result.

3. Find the square of 56 in a similar way and examine the result.

4. How do we find the square of a number made up of a number of tens and units?

5. Write down the square or second power of $(40 + 7)$.

6. Find the square root of 2025.

METHOD

$$\begin{array}{r}
 45 \\
 20, 25 \\
 16 \quad \cdot \\
 85 \overline{) 425} \\
 \underline{425}
 \end{array}$$

(1) Beginning with the units, separate the number 2025 into periods of two digits in each.

(2) What is the greatest square equal to or less than the left-hand period? We see the greatest square is 16. Take the square root of this which is 4, for the first figure in the square root. Subtract the square of this from the left-hand period.

- (3) To the remainder 4, annex the two digits of the next period, making 425.

(4) Multiply the first figure of the square root by 2, which gives as a trial divisor, 8 tens.

(5) We have in the dividend 42 tens and 5 units to be divided by 8 tens as trial divisor. The quotient is 5. This should be written in the root for the second figure or digit of the square root. It should also be written along with the trial divisor of 8 tens, making the complete divisor 85.

(6) Multiply the complete divisor, 85, by the last figure or digit of the root 5, and subtract the product from the dividend.

7. Find the square root of 4,124,961.

$$\begin{array}{r}
 2 \quad 0 \quad 3 \quad 1 \\
 \hline
 4, \quad 12, \quad 49, \quad 61, \\
 4 \\
 \hline
 403 \quad 12 \quad 49 \\
 \quad \quad 12 \quad 09 \\
 \hline
 \quad \quad 4061 \quad 40 \quad 61 \\
 \quad \quad \quad \quad 40 \quad 61 \\
 \hline
 \end{array}$$

$$\sqrt{4124961} = 2031.$$

8. Find the square root of 225.47856.

$$\begin{array}{r}
 1 \quad 5 \cdot 0 \quad 1 \quad 5 \\
 \hline
 2, \quad 25 \cdot 47, \quad 85, \quad 60 \\
 1 \\
 \hline
 25 \quad 1 \quad 25 \\
 \quad \quad 1 \cdot 25 \\
 \hline
 \quad \quad 3001 \quad .4785 \\
 \quad \quad \quad \quad 3001 \\
 \hline
 \quad \quad 30025 \quad 178460 \\
 \quad \quad \quad \quad 150125 \\
 \hline
 \quad \quad \quad \quad 28335
 \end{array}$$

$$\sqrt{225.47856} = 15.015.$$

In finding the square root of a number containing a decimal, beginning with the decimal point, mark off the integral part into periods with two digits, and in the same way, beginning with the decimal point, mark off the decimal part into periods containing two digits. Zeros may be annexed at the end of the decimal part.

Proceed as in the former examples.

Note. — Where a number is not a perfect square, it is not necessary to continue the work beyond the second or third decimal place.

Find the square root of each of the following :

EXERCISE

	<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>
1.	289	625	361	256
2.	576	1296	5625	729
3.	9025	2401	4096	104976
4.	1369	2209	3136	98596
5.	5184	4225	7225	62500

Find the square root of the following numbers. Where the number is not a perfect square the work should be carried to *three* places of decimals.

EXERCISE

	<i>a</i>	<i>b</i>	<i>c</i>
1.	390625	262144 ✓	117649 ✓
2.	499849	820836 ✓	522729 ✓
3.	734449	390625 ✓	492804 ✓
4.	445.02241	45.1584	3003.04
5.	27.5625	66.2596	345.00

EXERCISE

1. A man has a square field containing 10 acres. Find the length of the fence about the field. ✓

2. A man owns a section of land which is in the form of a square. Find the number of rods of fencing required to fence the farm. ✓

3. A rectangular garden is 3 times as long as it is wide. If it contains 1452 square yards, what is the length of the fence required to fence it?

4. A man owns a ranch containing 320 acres. The ranch is twice as long as it is wide. Find the cost of fencing the ranch at 75 cents per rod of fence.

5. A rectangular field is 360 feet long and 160 feet wide. What will be the perimeter of a square field which has the same area as this field?

6. A rectangular field is twice as long as it is wide. If the field contains 7.2 acres, find the cost of fencing the field at 17 cents per yard.

7. What is one of the two equal factors of 2,137,444?

8. A public hall contains 2646 square feet of floor space. Its length is $1\frac{1}{2}$ times its width. If the height of the hall is 15 feet, find the cost of painting the walls and ceiling of the hall at thirty-five cents per square yard.

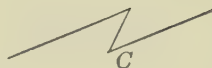
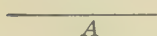
CHAPTER VII

MENSURATION

Lines and Angles

Introductory.

Examine the following lines :



What differences are noticeable?

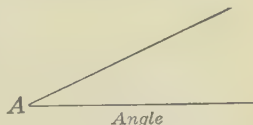
Line *A* is a straight line.

Line *B* is a curved line.

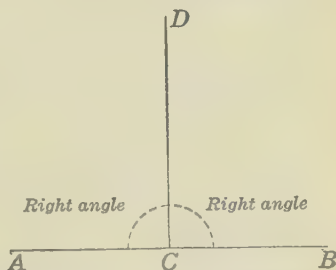
Line *C* is a broken line.

Draw two straight lines that meet at a point but are not in the same straight line.

The difference in direction of two straight lines that meet at a point is called an *Angle*.



An angle formed when one straight line meets another straight line so as to make the adjacent angles equal is called a *Right Angle*.

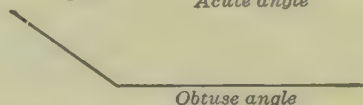


The lines *AB* and *CD* forming the right angles are said to be *Perpendicular* to each other.

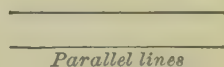
An angle less than a right angle is called an *Acute Angle*.



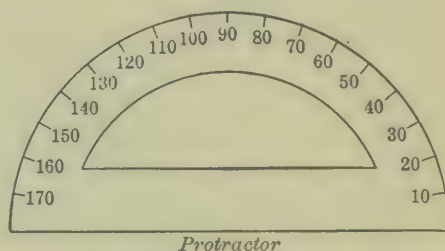
An angle greater than a right angle is called an *Obtuse Angle*.



Parallel Lines are lines which have the same direction and are equally distant at all points.



Draw this figure on cardboard and cut it out. It is called a *Protractor*. Measure an angle of 60° ; of 90° ; of 75° ; of 120° ; of 10° ; of 45° .

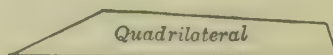


Draw two lines, one due east, and from one end of this line another due north. What kind of an angle do they form? How many degrees are there in this angle?

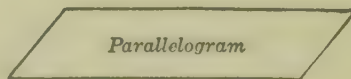
Quadrilaterals

A *Plane Surface* or plane figure is a surface such that a straight line joining any two points on it lies wholly in that surface. If a straight edge is placed in any direction on a plane surface, all parts of the straight edge will touch the plane surface. A plane surface has two dimensions, length and breadth.

A *Quadrilateral* is a plane figure having four straight sides.



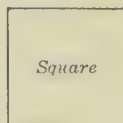
A *Parallelogram* is a quadrilateral whose opposite sides are parallel.



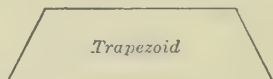
A *Rectangle* is a parallelogram whose angles are all right angles.



A *Square* is a rectangle whose sides are equal.



A *Trapezoid* is a quadrilateral having only two sides parallel.



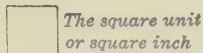
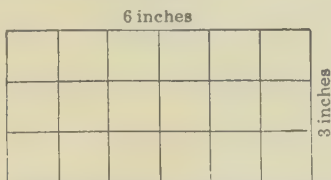
Any straight line drawn perpendicular to and joining the parallel sides of a parallelogram or trapezoid is called the *Altitude*.

The straight line joining the opposite corners of a quadrilateral is called the *Diagonal*.

Rectangle

The rectangle is the only plane figure whose area may be directly found by applying the unit of measure (a square) and then counting the number of times it is applied.

To find the area of a rectangle 6 in. long and 3 in. wide The square unit used in finding the area is a square whose sides are one inch long.



How many square units are there in one row?

How many square units are there in the three rows?

How many square inches are there in the three rows?

What is the area of the rectangle?

Area = $6 \times 3 \times 1$ square inch = 18 square inches.

EXERCISE

1. Show by a drawing that a rectangle 7 in. long and 4 in. wide contains 28 sq. in.
2. Draw a rectangle 5 in. long containing 20 sq. in. How wide is the rectangle?
3. Show that a rectangle containing 72 sq. in. and 9 in. long is 8 in. wide.

ORAL EXERCISE

1. Find the area of the floor of a room 15 feet long and 8 feet wide.
2. A book is 14 inches long and 6 inches wide. Find the area of the cover.
3. The area of a flower bed is 112 square feet. The bed is 8 feet wide. What is its length?
4. A garden contains 2400 square feet. If the garden is 60 feet long, what is its width?
5. What is the perimeter of a rectangle two sides of which are $12\frac{1}{2}$ feet and $6\frac{1}{4}$ feet respectively?
6. A blackboard is 4 ft. wide and 18 ft. long. Find its area expressed in square yards.
7. What is the difference between 4 sq. inches and 4 inches square?
8. The surface of a slate contains 96 sq. in.; the slate is 1 ft. long. How wide is it?

EXERCISE

1. How much more floor surface has a room 16 ft. long and 12 ft. wide than a room 18 ft. long and 9 ft. wide?
2. A city lot with a frontage of 50 ft. and a depth of 120 ft. is valued at \$30 per foot frontage. What is the value of the lot per square foot?

3. Find the cost of building a cement sidewalk 8 ft. wide and 30 rd. long at 90¢ per square yard.

4. A contractor lays a sidewalk 8 ft. wide on both sides of a street one-quarter of a mile long. The 2 in. plank used is supported by three continuous lines of scantling 4 in. by 4 in. Find the cost of the lumber at \$30 per M.

5. Trees are planted 12 ft. apart around the sides of a rectangular field 40 rd. long and containing 2 acres. Find the number of trees required.

6. How many blocks 12 in. by 18 in. will be required to pave a street $\frac{1}{8}$ mi. long and 45 ft. wide?

7. A farmer estimates 9.75 tons of green feed to the acre from a field of oats. If the field is 40 rd. long and 32 rd. wide, how many tons does he expect?

8. A farmer sows 12 oz. of wheat to a sq. rd. of his farm. How many bushels will he require to seed a section?

9. A rectangular field whose length is four times its width contains 10 acres. Find its dimensions.

10. A map is drawn to the scale of $\frac{1}{2}$ inch to a mile. How many acres are represented by a square inch on the map?

11. At 45¢ per rod it costs \$79.20 to fence a rectangular field. The field is 220 yd. wide. Find its area expressed in acres.

EXERCISE

1. A room is twice as long as it is wide, and its floor area is $76\frac{1}{8}$ sq. yd. Find its length and width.

2. At 30¢ per roll of 8 yd., what will be the cost of paper for the walls and ceiling of a room, the paper being 18 in. wide, the room being 24 ft. long, 21 ft. wide, and 12 ft. high, and no deductions being allowed for openings?

3. A railing encloses a rectangular field of 15 A. The length of the field is to its breadth as 3 to 2. Find the length of the railing.

4. In what time would a rectangular field 80 rd. $\times$ 60 rd. pay for underdraining lengthwise at 2¢ per foot, if the field yields 2 bush. per acre more than before draining and the grain is worth 66¢ per bush.? The drains are 4 rd. apart, and the first drain runs down the centre of the field.

5. I bought a bush farm 180 rd. long by 96 rd. wide at \$12.50 per acre. I paid \$14.75 per acre for clearing and \$1.35 per rod for enclosing the whole farm with wire fencing. Taking into account that I sold the wood for \$1160, how much has the improved farm cost me per acre?

6. A rectangular map measures 4 ft. 6 in. by 3 ft. 3 in. and is drawn on the scale of $\frac{1}{8}$ in. to a mile. How many acres does the map represent?

7. On a map drawn to the scale of $\frac{1}{2}$ in. to a mile, a township measures $3\frac{1}{3}$ in. long by $1\frac{4}{5}$ in. wide. How many acres are there in it?

8. A four-foot sidewalk of 2-in. planks is to be laid round a square field containing 10 A. The inner edge of the sidewalk is to be two feet out from the boundary of the field. Find the cost of the planking in the sidewalk at \$15 per M.

9. Find the cost of fencing a square lot containing $2\frac{1}{2}$ A. with wire fencing five wires high at 2¢ per foot.

10. Find the cost of covering the floor of a hall $54\frac{1}{2}$ ft. long and 16 ft. 8 in. wide with linoleum at \$.96 per square yard.

The Parallelogram

Cut from paper or cardboard a parallelogram of some convenient size. Fig. 1.

Draw a perpendicular from C to AB . CR is the altitude of the parallelogram.

Cut off the shaded part CRB and place it in the position ADS .

The plane figure $DSRC$ is made up of the same parts as the original parallelogram $ABCD$. Compare the areas of these two plane figures. What name do you give to the plane figure $DSRC$? Name its base. Compare the length of its base with that of the parallelogram. Compare its altitude with that of the parallelogram. How do you find its area?

The area of a parallelogram is equal to that of a rectangle whose length is equal to the base of the parallelogram and whose width is the altitude of the parallelogram. Hence the number of square units in the area of a parallelogram is the product of the number of units of length in its base, and the number of units of length in its altitude.

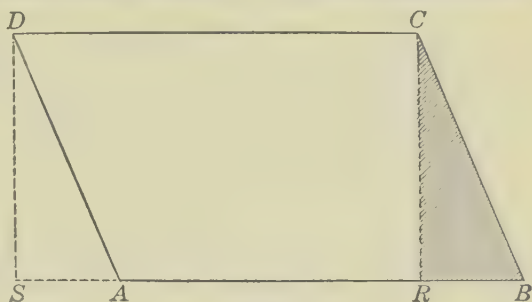


FIGURE 1

ORAL EXERCISE

Give the area of the following parallelograms:

1. Base 14 in., height 9 in.
2. Base 12 in., height $6\frac{1}{2}$ in.
3. Base $1\frac{1}{2}$ ft., height 8 in.
4. Base 15 in., height 12 in.
5. Base 16 ft. 6., height 4 ft.

Give the height of the following parallelograms:

1. Base 15 in., area 90 sq. in.
2. Base 12 ft., area 102 sq. ft.
3. Base 16 in., area 68 sq. in.

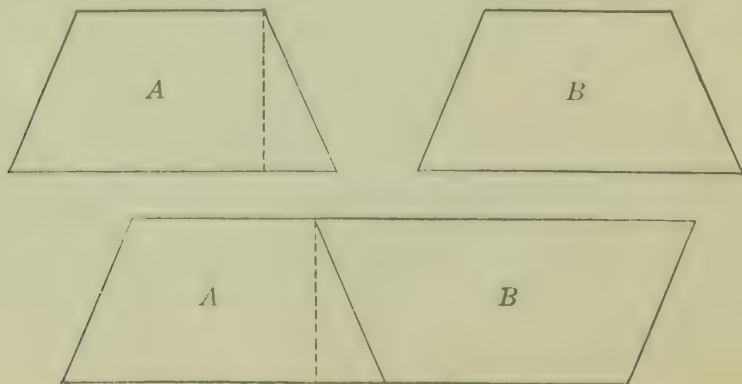
EXERCISE

1. Find the area of the following parallelograms :
 - (a) Base, 3 ft. 4 in., altitude, 2 ft. 6 in.
 - (b) Base, 24 ch. 61 links., altitude, 16 ch. 25 links.
 - (c) Base, 40 rd. 4 yd., altitude, 24 rd. 5 yd.
2. A strip of land in the form of a parallelogram is 80 rd. long and 36 rd. wide. Find its area expressed in acres.
3. The area of a parallelogram is 576 sq. ft., and its altitude is 18 ft. Find its length.
4. The base of a parallelogram is 27 in., and its area is 3 sq. ft. Find its altitude.

The Trapezoid

Cut out of paper two trapezoids *A* and *B* of convenient size and exactly alike.

Place them end to end as in figure formed by *A* and *B*. Of what form is this figure?



It is evident that the length of the base of this parallelogram is equal to the sum of the lengths of the two parallel sides of the trapezoid, and its altitude is equal to the altitude of the trapezoid. Its area is also equal to twice the area of the trapezoid.

Hence, the number of square units in the area of a trapezoid is equal to one-half of the product of the sum of the linear units in its parallel sides and the number of linear units in its altitude.

ORAL EXERCISE

Find the area of the following trapezoids:

1. Parallel sides 12 in. and 10 in., height 8 in.
2. Parallel sides 6 in. and 12 in., height 6 in.
3. Parallel sides 12 in. and 9 in., height 10 in.
4. Parallel sides 18 in. and 15 in., height 4 in.
5. Parallel sides 2 ft. and 8 in., height 5 in.
6. Parallel sides 24 ft. and 26 ft., height 25 ft.

EXERCISE

1. Find the area of a trapezoid whose parallel sides are 10 in. and 12 in. in length and whose altitude is 8 in.

2. A field is in the form of a trapezoid. The parallel sides are 85 rd. and 75 rd. long, and the width of the field is 60 rd. How many acres are there in the field?

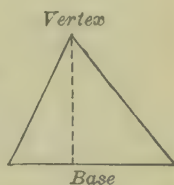
3. A 2 in. plank 18 ft. long is 10 in. wide at one end and 12 in. wide at the other. How many board feet are there in this plank?

4. The city bought a plot of land in the form of a trapezoid for a public playground. The parallel sides of this plot are 360 ft. and 420 ft. long, and its width is 242 ft. Find the cost of this plot of land at \$450 per acre.

Triangles

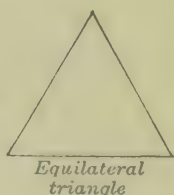
A *Triangle* is a plane figure having three straight sides and three angles.

The side on which the triangle stands is the *Base*, and the opposite corner, the *Vertex*.



The perpendicular dropped from the vertex on the base is the *Altitude*.

A triangle that has three equal sides is called an *Equilateral Triangle*.



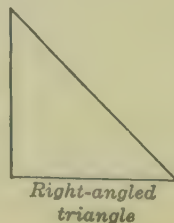
A triangle that has two equal sides is called an *Isosceles Triangle*.



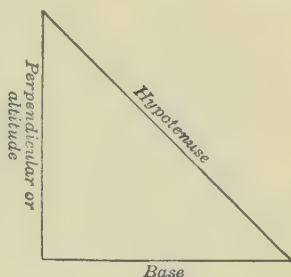
A triangle having no two sides equal is called a *Scalene Triangle*.



A triangle having one of its angles a right angle is called a *Right-angled Triangle*.



The side opposite the right angle is called the *Hypotenuse* and the other sides, the *Base* and the *Perpendicular*.

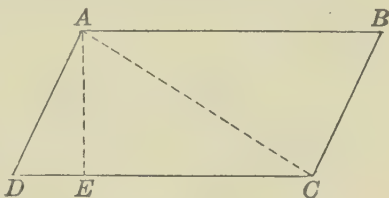


Triangles are also classified as *Acute-angled* or *Obtuse-angled*, depending upon the size of the largest angle.

To find the area of a triangle:

Draw a parallelogram $ABCD$. Mark the diagonal AC . Into how many triangles does AC divide the parallelogram?

Mark the altitude AE of the parallelogram. Divide the parallelogram into two triangles by cutting along the line AC . Apply one triangle to the other. Are their areas equal?



What part of the parallelogram is the triangle ADC ?

The area of the parallelogram is $DC \times AE$; the area of the triangle ADC is $\frac{1}{2} DC \times AE$.

Hence the area of the triangle is one-half the product of the number of linear units in its base and the number of linear units in its altitude.

Show how to find the area of a right-angled triangle.

ORAL EXERCISE

1. Find the areas of the following triangles:

(a) Base 12 in., height 5 in.

(b) Base 20 in., height 12 in.

(c) Base 1 ft. 6 in., height 2 ft.

2. What is the perimeter of an equilateral triangle 14 inches on a side?

3. What is the area of an equilateral triangle whose perimeter is 48 inches and whose altitude is 10 inches?

4. The area of a triangle is 36 sq. in. The altitude is 9 in. Find the length of the base.

5. The perimeter of an isosceles triangle is 42 ft. The length of each of the equal sides is 15 ft. Find the length of its base. If its altitude is 14 ft., find its area.

6. The area of an equilateral triangle is 24 sq. in. The altitude is 6 in. Find the perimeter.

EXERCISE

1. Find the area of a triangle whose base is 14 in. and altitude 9 in.

2. The length of one side of a triangular field is 72 rd., and the perpendicular distance from this side to the opposite corner is 40 rd. How many acres does this field contain?

3. The area of a triangle is 72 sq. in. The altitude is 16 in. Find the length of the base.

4. A rectangle is 16 in. long and 10 in. wide, and a triangle has a base 8 in. long and an altitude of 10 in. How many times greater is the rectangle than the triangle?

5. Find the area of the following right-angled triangles :

(a) Base $6\frac{1}{2}$ yd., perpendicular side 13 yd.

(b) Base 10 yd. 2 ft., perpendicular side 10 yd. 2 ft.

(c) Base 3 chains, perpendicular side 40 yd. 1 ft.

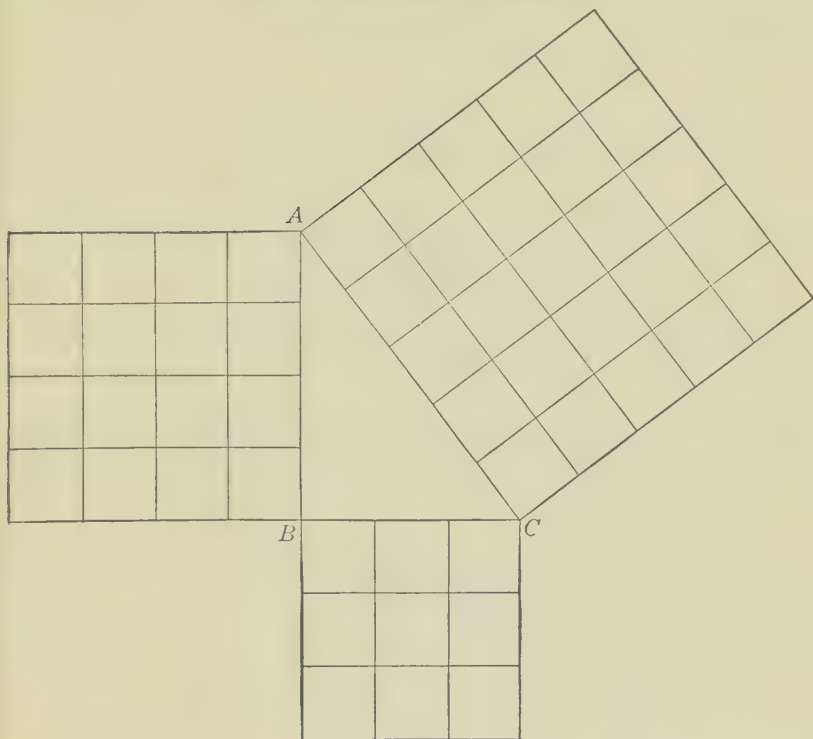
6. Find the perpendicular or base of the following right-angled triangles :

(a) Area 195 sq. ft., base 26 ft.

(b) Area $2\frac{1}{2}$ acres, perpendicular 110 yds.

(c) Area $76\frac{1}{2}$ acres, perpendicular 7200 links.

The Right-angled Triangle



Construct a right-angled triangle having the base BC 3 in. long and the perpendicular side AB 4 in. long. On the base, on the perpendicular, and on the hypotenuse of this triangle construct squares. Measure the length of the hypotenuse. Divide these squares into units of one square inch. Count the number of unit squares in each of the large squares. Compare the number of unit squares on the hypotenuse with the sum of the unit squares on the base and the perpendicular. How does the area of the square on the hypotenuse compare with the sum of the areas of the squares on the other two sides?

The area of the square on the hypotenuse of a right-angled triangle is equal to the sum of the areas of the squares on the other two sides.

EXERCISE

1. Draw right-angled triangles with the following dimensions :

- (a) Base 6 in., perpendicular 8 in.
- (b) Base 12 in., perpendicular 5 in.
- (c) Base 9 in., perpendicular 12 in.

Measure the length of the hypotenuse of each triangle.

What is the area of the square on the hypotenuse in each case?

Compare the area of the square on the hypotenuse with the sum of the areas of the squares on the other two sides in Exs. (a), (b), (c).

Given the length of any two sides of a right-angled triangle, to find the length of the third side :

Example : The perpendicular is 6 in. and the base 8 in. in length, to find the length of the hypotenuse.

$$\begin{aligned}
 \text{Area of square on perpendicular} &= 36 \text{ sq. in.} \\
 \text{Area of square on base} &= 64 \text{ sq. in.} \\
 \therefore \text{area of square on hypotenuse} &= 100 \text{ sq. in.} \\
 \therefore \text{the length of hypotenuse} &= \sqrt{100} \text{ in.} \\
 &= 10 \text{ in.}
 \end{aligned}$$

Example : The base is 12 in. and the hypotenuse is 13 in. in length, to find the length of the perpendicular.

$$\begin{aligned}
 \text{Area of square on hypotenuse} &= 169 \text{ sq. in.} \\
 \text{Area of square on base} &= 144 \text{ sq. in.} \\
 \therefore \text{area of square on perpendicular} &= 25 \text{ sq. in.} \\
 \therefore \text{length of perpendicular} &= \sqrt{25} \text{ in.} \\
 &= 5 \text{ in.}
 \end{aligned}$$

EXERCISE

Find the hypotenuse of each of the following right-angled triangles, whose base and perpendicular are, respectively :

1. 35 ft. and 12 ft.
2. 31 ft. 6 in. and 56 ft. 8 in.
3. 408 ft. and 506 ft.

Find the base of each of the following right-angled triangles, whose perpendicular and hypotenuse are :

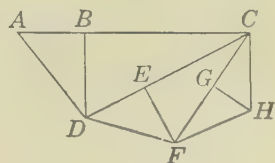
4. 36 in. and 85 in.
5. 117 ft. and 125 ft.
6. 24 chains and 74 chains.
7. 1 ft. 2 in. and 4 ft. 2 in.

Find the perpendicular of the following right-angled triangles, whose base and hypotenuse are, respectively :

8. 56 yd. and 394 yd.
9. 2 rd. and 3 rd. 5 yd. 6 in.
10. 1 chain 40 links and 5 chains.
11. Find the area of the following figure :

$$\begin{aligned} AC &= 1.26 \text{ in.} \\ CD &= .95 \text{ in.} \\ CF &= .71 \text{ in.} \end{aligned}$$

$$\begin{aligned} BD &= .55 \text{ in.} \\ EF &= .4 \text{ in.} \\ GH &= .21 \text{ in.} \end{aligned}$$



EXERCISE

1. If the gable end of a house 64 ft. wide is 24 ft. high, what is the length of the rafters?

2. Find the width of a house whose rafters are 12 ft. and 16 ft. respectively, and form a right angle where they meet.

3. A ladder 85 ft. long stands close against a building. How far must it be drawn out at the foot that the top may be lowered 1 ft.?

4. A tree was broken 51 ft. from the top and fell so that the end struck 24 ft. from the foot. What was the length of the tree?

5. A owns a rectangular lot 168 ft. by 95 ft. What is the distance through it from opposite corners?

6. A rope 190 ft. long will reach from the top of a pole to a point on the opposite bank of a river whose width is 152 ft. Find the height of the pole.

7. A ladder 34 ft. long stands upright against a wall. If it is pulled out 16 ft. at the bottom, how far will the top be lowered?

8. Two towers 94 ft. and 78 ft. high are on opposite banks of a stream 30 ft. broad. What is the length of the shortest line connecting the tops of the towers?

9. A field in the form of a right-angled triangle has a base of 720 feet and a hypotenuse of 962 ft. Find the cost of fencing it at 21¢ per foot.

10. What is the shortest distance between the lower corner and the upper opposite corner of a room 60 ft. long, 32 ft. wide, and 51 ft. high?

11. What is the length of the longest straight rod which, without bending, can be put into a box 5 ft. long, 1 yd. wide, and $\frac{3}{4}$ yd. deep?

The Circle

With a pair of compasses, or a pencil and string, describe a circle.

Point out the centre, the radius, the diameter, the circumference.

What relation does the radius bear to the diameter?

Every point in the circumference is at what distance from the centre?

A plane figure bounded by a curved line such that every point in this curved line (the circumference) is at the same distance from the centre, is a circle.

Procure a round ruler 1 in. in diameter and find what length of string will just reach round it.

Measure a cylinder 7 in. in diameter to find what length of string will just reach round it.

Measure the circumference and diameter of a stove pipe and compare the length of the circumference with that of the diameter.

It is found that the circumference of a circle divided by the diameter = 3.1416, which is usually denoted by the Greek letter π . For practical purposes $\pi = 3\frac{1}{7}$.

EXERCISE

Find the circumferences of circles whose diameters are:

- | | | |
|----------------|-----------------------|-----------------------|
| 1. 35 ft. | 4. 1 rd. 5 yd. | 7. 20 ft. |
| 2. 91 chains. | 5. 3 chains 50 links. | 8. 4 chains 76 links. |
| 3. 4 yd. 2 ft. | 6. 7 chains 84 links. | 9. 5 yd. 1 ft. 4 in. |

Find the diameter of circles whose circumferences are:

- | | | |
|------------------|--------------|------------------------|
| 10. 44 in. | 13. 264 in. | 16. 64 rd. |
| 11. 10 ft. 1 in. | 14. 3520 ft. | 17. 5 chains 39 links. |
| 12. 3 yd. 2 in. | 15. 15.4 mi. | 18. 73 yd. 1 ft. |

19. The radius of a circle is 24 in. Find its circumference. ✓

20. A wire may be so bent as to enclose a square whose area is 484 sq. in. If this wire were bent into the form of a circle, what would be its radius?

21. The radius of a fountain is 21 ft. Find the cost of enclosing it with an iron railing at \$3.60 per yard.

22. A locomotive is travelling at the rate of 60 mi. per hour, and the diameter of its driving wheel is 3 ft. 6 in. How many times does it turn in a second?

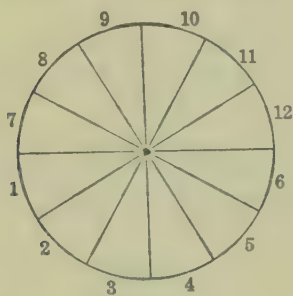


FIGURE 2

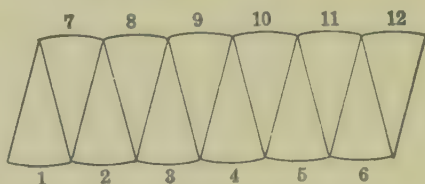


FIGURE 3

From a piece of leather or strong paper make a circle and divide it into triangles as in Fig. 2. Change the circle into the form of Fig. 3. Into what shape, nearly, has the circle been changed?

If the circle had been cut into twice as many equal parts and arranged as in Fig. 3, it would still more nearly resemble the shape of what figure?

What is the length of Fig. 3 in terms of the circumference?

What is the width of the figure in terms of the radius?

Compare the area of Fig. 3, with that of the circle in Fig. 2.

The area of a circle is the same as that of a rectangle having a base equal to one-half the circumference and altitude equal to the radius.

Hence, the number of square units in the area of a circle is equal to one-half the product of the number of linear units in its circumference and the number of linear units in its radius.

If Fig. 3 is 22 in. long and 7 in. wide, what is its area?

What is the area of a circle 7 in. in radius?

What is the area of a circle 14 in. in radius?

EXERCISE

Find the area of circles with the following diameters :

- | | | |
|-----------|------------|---------------|
| 1. 84 in. | 3. 525 ft. | 5. 483 links. |
| 2. 98 yd. | 4. 133 ft. | 6. 126 ft. |

Find the area of circles with the following circumferences :

- | | | |
|-----------------|------------|----------------|
| 7. 77 in. | 9. 220 yd. | 11. 473 links. |
| 8. 90.2 chains. | 10. 3 rd. | 12. 1 mi. |

Find the area of circles with the following radii :

- | | | |
|-----------------|---------------|-----------------|
| 13. 3 ft. 6 in. | 15. 7 chains. | 17. 1 rd. 5 yd. |
| 14. 7 ft. 7 in. | 16. 1.75 rd. | 18. 35 chains. |

EXERCISE

1. How many square yards of cement would be required to cover a circular hall, 45 ft. in diameter?

2. The circumference of a race track is 1 mi. What is its area?

3. How many feet of iron must a blacksmith buy for the tires of 12 wheels 4 ft. in diameter?

4. What space would the driving wheel of a locomotive 5 ft. 3 in. in diameter pass over in making 25 revolutions?

5. Find the radius of a circle equal in area to the sum of three circles whose radii are 8 in., 9 in., and 12 in.

6. A circular lawn, 220 yd. in diameter, is surrounded by a gravel path 12 ft. wide. Find the cost of making the path at 36¢ per square yard.

7. Two circles, the radii of which are $3\frac{1}{2}$ in., are placed upon one whose diameter is 14 in. Find the area of the surface not covered.

8. The diameter of a circle is 126 in. Find the length of an arc of 50° ; of 65° ; of 80° ; of 90° .

9. A circular lawn contains $2\frac{1}{2}$ A. Find its radius.
10. A circle 5 ft. 2 in. in diameter has another 2 ft. 4 in. in radius inscribed within it. Find the area of the part of the large circle without the smaller one.
11. The diagonal of a square is $5\frac{1}{4}$ ft. Find the circumference of a circle circumscribed about the square.



Rectangular Solids

Fig. A is a rectangular solid of which $abcd$ is its upper surface. As in the rectangle, page 181, lines are drawn dividing the sides into equal squares. The number of cubic units of measure which can be placed on the line bc corresponds to the number of linear units of measure in that line; and the number that can be placed on the surface $abcd$ is the number on bc multiplied by the number of linear units of measure in the adjacent side ab . If the number of cubic units of measure on $abcd$ be multiplied by the number of linear units of measure corresponding to the height of the solid, the product will be the number of cubic units of measure in the whole solid.

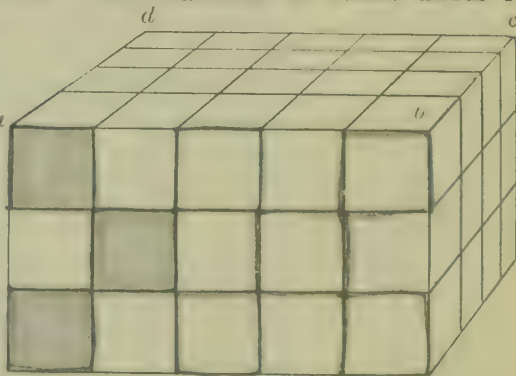


FIGURE A

Hence, to find the number of cubic units of measure in a rectangular solid, multiply the number of linear units of measure that can be placed on a line called the breadth, by the number of linear units of measure in the length, and this product by the number of linear units of measure in the height.

EXERCISE

1. Find (a) the surface area and (b) the volume of a cube whose edge is $4\frac{1}{2}$ in. long.

Find (a) the surface area and (b) the volume of the following covered boxes :

2. Length 6 ft., width $2\frac{1}{2}$ ft., depth $3\frac{1}{2}$ ft.

3. Length 9 in., width $4\frac{1}{3}$ in., depth $2\frac{1}{4}$ in.

4. How many 2-in. cubes will be required to build a cube with an edge 12 in. long?

5. How much does the surface area of the small cubes in Question 4 exceed that of the large one?

6. A schoolroom 34 ft. by 25 ft. is intended to accommodate 50 pupils. What must be its height to allow 250 cu. ft. of air-space for each pupil?

7. Find the volume of a cube, the area of whose entire surface is 7 sq. ft., 6 sq. in.

8. A piece of copper 1 ft. long, 9 in. wide, and $\frac{5}{8}$ in. thick is rolled into a plate 6 ft. long and 4 ft. wide. How thick will the plate be?

9. A log of square timber is 18 ft. long, 18 in. broad, and 15 in. thick. If $2\frac{1}{2}$ solid feet are cut off the end of it, what length is left?

10. A cistern is partly full of water and has 250 gal. in it. If the length of the cistern is $6\frac{1}{4}$ ft. and the breadth $3\frac{1}{2}$ ft., find the depth of the water.

11. A cistern is $12\frac{1}{2}$ ft. long and 8 ft. wide. If, when it is full of water, 1500 gal. are drawn off, how much will the surface of the water sink?

EXERCISE

1. A rectangular room 15 ft. high, whose length is one-half more than its width, contains 12,960 cu. ft. of air space. Find its length.

2. A rectangular tank holds $12\frac{1}{2}$ T. of water. If it is 16 ft. long and 4 ft. wide, how deep is it, 1 cu. ft. of water weighing 1000 oz.?

3. A closed tank made of plank 2 in. thick, is 10 ft. long, 4 ft. wide, and 5 ft. 4 in. deep, external measurement. How many gallons of water will it hold, a gallon of water being $\frac{4}{25}$ of a cubic foot?

4. The surface area of a rectangular solid 1 ft. 3 in. long and 14 in. wide is 1000 sq. in. Find its depth.

5. A brick with mortar occupies a space 9 in. long, $4\frac{1}{2}$ in. wide, and 3 in. deep. How many bricks will be required for a wall 90 ft. long, $13\frac{1}{2}$ in. thick, and 6 ft. high?

6. A rectangular block of wood measures 1 ft. 10 in. wide and 1 ft. 3 in. thick. What length must be cut off it to contain 11 cu. ft.?

7. A rectangular cistern 8 ft. long and $6\frac{1}{4}$ ft. wide is full of water. How much will the water sink when 1000 gal. are drawn off?

8. It costs \$584.50 to excavate the basement of a rectangular building $125\frac{1}{4}$ ft. long and 28 ft. wide, at 25¢ per cubic yard. How deep is the excavation?

9. A cubic foot of copper is rolled into a rectangular sheet 48 ft. long and 4 ft. wide. How thick is the sheet?

10. A rectangular cistern 4 ft. long and $3\frac{1}{2}$ ft. wide has 500 gal. of water in it. How deep is the water?

11. A cubic foot of swamp oak weighs 43 lb. Find the weight of 15 planks, each 24 ft. long, 14 in. wide, and 3 in. thick.

12. Water in freezing expands 10%. How many loads of ice of 2 tons each will be required to fill an ice house 44 ft. long, 40 ft. wide, to a height of 20 ft., assuming that a cubic foot of water weighs 1000 oz.?

The Cylinder

1. Examine a cylinder.

- (a) How many parts are there in its surface?
- (b) What is the shape of each end face?
- (c) Compare the areas of the end faces.
- (d) Imagine a straight line joining the centres of the two end faces; at what distance from this line is every part of the curved face?



2. Describe a cylinder.

3. (a) Fit a sheet of paper over the curved face of a cylinder.

- (b) Examine the shape of this sheet.
- (c) Compare the area of the sheet with the area of the curved face.
- (d) State the dimensions of the sheet of paper in terms of the dimensions of the cylinder.
- (e) How is the area of the sheet of paper found?
- (f) How is the area of the curved face of a cylinder found?

4. (a) A cylinder is 7 in. in radius and 12 in. long. Find the area of its surface.

- (b) What is the area of one end? Of the two ends?
- (c) What is the length of the circumference of the cylinder?
- (d) What is the area of the curved face?
- (e) What is the area of the entire surface?

EXERCISE

Find the surface of each of the cylinders whose diameter and height are, respectively :

- | | |
|----------------------------------|--------------------------|
| 1. 42 in. and 40 in. | 4. 126 in. and 20 ft. |
| 2. $3\frac{1}{2}$ in. and 10 in. | 5. 21 ft. and 4 ft. |
| 3. 14 ft. and 5 ft. | 6. 8 ft. 2 in. and 4 ft. |

Find the volume of each of the cylinders whose diameter and height are, respectively :

- | | |
|----------------------------------|------------------------|
| 7. 14 in. and 1 ft. | 10. 14 ft. and 5 ft. |
| 8. 42 in. and $3\frac{1}{3}$ ft. | 11. 21 ft. and 6 ft. |
| 9. 3 ft. 6 in. and 15 in. | 12. 105 in. and 16 ft. |

Find the diameter of each of the cylinders whose solid content and height are, respectively :

- | | |
|-----------------------------|---|
| 13. 308 cu. in. and 8 in. | 16. $115\frac{1}{2}$ cu. ft. and 12 ft. |
| 14. 1331 cu. in. and 14 in. | 17. 2079 cu. ft. and 24 ft. |
| 15. 385 cu. ft. and 10 ft. | 18. $513\frac{1}{3}$ cu. ft. and 40 in. |

EXERCISE

1. The area of the curved face of a cylinder is 440 sq. in. It is 5 in. in radius. Find its height.

2. A roller is 6 ft. long and 3 ft. 6 in. in diameter. How much ground is rolled in 1000 revolutions?

3. How often would the roller in the last example turn in rolling a 10-acre field?

4. Find the cost, at 25¢ per square foot, of decorating the curved face of a pillar 21 ft. high and 18 in. in diameter.

5. It cost \$31.68 to decorate the curved face of a pillar 21 ft. high at 36¢ per square foot. Find the diameter of the pillar.

6. A cylinder of copper 1 ft. high and 7 in. in diameter is rolled out into a plate 8 in. wide and $\frac{1}{4}$ in. thick. How long is the plate?

7. The cent is an inch in diameter and $\frac{1}{16}$ in. thick. How many cents can be coined from a cylinder of copper 6 in. in diameter and 1 ft. high?

8. Find the cost, at \$1.75 per cubic yard, of sinking a shaft 120 ft. deep and 6 ft. in diameter.

9. If a cubic foot of iron weighs 488 lbs., find the weight of a solid iron pillar 14 ft. long and 9 in. in diameter.

10. How many cubic feet of earth must be taken out in digging a well 30 ft. deep and 6 ft. in diameter?

REVIEW EXERCISE

1. Find the area of a board 5 ft. long, 12 in. wide at one end and 6 in. at the other.

2. Draw on paper a figure with two parallel sides 3 in. and 4 in. long and altitude 2 in. Find its area.

3. If a ton of coal is equal to 36 cu. ft., how many tons can be put into a bin $8\frac{1}{4}$ ft. wide, $8\frac{1}{2}$ ft. deep, and 18 ft. long?

✓ 4. Find the volume of a cylindrical column 40 ft. high and 3 ft. in diameter.

✓ 5. A circular pond 5 ch. in diameter is covered with ice 8 in. thick. How many cubic feet of ice are there on the pond?

+ 6. An ice dealer stored the ice from 5 A. of a lake. The ice was of an average thickness of 2 ft. Find the weight of the ice, each cubic foot weighing $56\frac{1}{2}$ lbs.

✓ 7. Find the cost of slating a roof 50 ft. 6 in. long at \$12.50 a square, each side of the roof being 24 ft. (A square = 100 sq. ft.)

✓ 8. A bushel contains 2218.2 cu. in. How many bushels will a bin 8 ft. long, 5 ft. wide, and 6 ft. deep contain?

✓ 9. A reservoir in the form of a cylinder is 350 ft. in diameter. How many gallons does it contain when filled to the depth of 20 ft.? (1 cubic ft. = $6\frac{1}{4}$ gal.)

10. The area of a triangle is 250 sq. ft.; its altitude is $6\frac{1}{4}$ ft. Find its base.

11. Find the area of a triangle with two equal sides, each of which is 50 rd. long, and the base 40 rd. long.

12. How far from the bottom of a building 70 ft. high must the foot of a ladder 72 ft. long be placed, so that it may just reach to the top of the building?

13. The sides of a rectangle are to each other as 4 to 3. The diagonal is 55 ft. long. Find its area.

14. Find the side of the largest square that can be inscribed in a circle 10 ft. in diameter.

15. Find the distance from a lower corner to the opposite upper corner of a rectangular room 32 ft. long, 24 ft. wide, and 16 ft. high.

16. At \$2.25 a rod, how much less will it cost to fence a field 80 rd. square than a field of the same area one-fourth longer?

17. A roof is 36 ft. long, and each side is 24 ft. wide. Slates are 16 in. by 12 in. and lap 10 in. How many slates will it take?

✓ 18. How many board feet are there in 84 boards, each 7 ft. long, 10 in. wide, and 1 in. thick?

✓ 19. Estimate the number of gallons of water in a well $4\frac{1}{2}$ ft. in diameter when the water is 9 ft. deep.

20. A lot was bounded as follows: beginning at the north-east corner the line ran west 40 ft., then south 75 ft., and then east 100 ft., then to the north-east corner. Find the cost of sodding this lot at 15¢ per square yard.

✓ 21. A room is heated by 350 feet of steam pipe 2 in. in diameter. Find the area of the curved surface which radiates the heat.

22. How many gallons of water are there in a cylindrical tank 35 ft. high and 21 ft. in diameter when the tank is full? (1 cubic ft. = $6\frac{1}{4}$ gal.)

23. The globe in school is 12 in. in diameter. Find the length of the equator and of a degree of latitude at the equator.

24. At 84¢ per sq. yd. it cost \$26.88 to pave a triangular court, the base of which was 32 ft. Find the altitude of the court.

25. The perimeter of a square and the circumference of a circle are each 44 ft. Which has the greater area and by how much?

26. Find the cost of concreting the bottom of a circular fountain 63 ft. in diameter at \$1.50 per square yard.

27. Two vessels sail from the same port. One sails due north at the rate of 13 mi. per hr. and the other due west at the rate of 14 mi. per hr. How far apart are they at the end of 12 hr.?

28. Find the cost of material for a 4-ft. sidewalk 240 feet long of 2-in. plank resting on two rows of 2"×6" scantling, if lumber is worth \$26 per M.

29. The cost of building a sidewalk 120 feet long of 2-inch plank, supported on two lines of 2"×6" scantling at \$25 per M., was \$30. Find the width of the sidewalk.

30. A sidewalk 3 ft. wide of 2-inch plank, supported by two rows of 2"×5" scantling, is built the full length of a block 500 ft. long. How much more would the sidewalk have cost had it been 5 ft. wide, lumber being worth \$28 per M.?

31. How many sq. yds. of oilcloth are needed for a kitchen floor 15 ft.×21 ft., allowing 5 per cent more than the area for matching?

32. A farmer, who has a section of wheat, makes the first cut around it with a binder having a $5\frac{1}{2}$ ft. cutting-bar.

(a) How long will it take to make the first round, if the horses travel at the rate of 3 miles an hour?

(b) How many acres does he cut the first round?

(c) If four binders, each with a $5\frac{1}{2}$ ft. cutting-bar, are set to work, how many acres remain uncut after each machine has made 18 rounds?

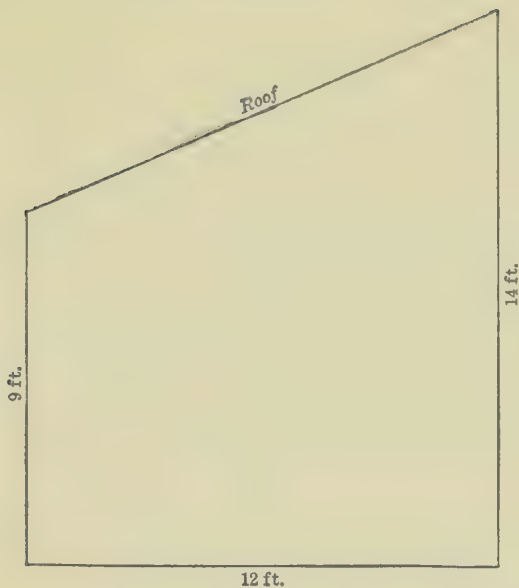
✓33. Find the cost of laying a granolithic sidewalk 120 ft. long and 4 ft. wide, at 45¢ per sq. yd.

✓34. Find the cost of cementing the floor of a cellar 18 ft. $\times$ 15 ft., if it requires one cubic yard of gravel at \$1.50 a yard and 2 sacks of cement worth 90¢ a sack for every 3 square yards.

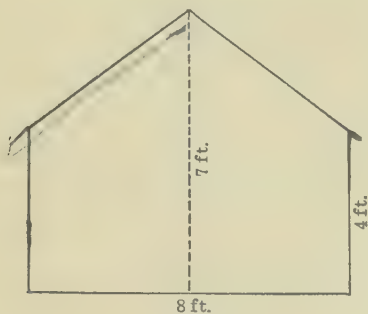
35. In Question 28, had a granolithic walk been laid, what would the cost have been, (a) if the cost of laying it was 5 cents a square foot; (b) if it had cost 24 cents a running foot?

36. A close board fence of inch lumber 4 ft. high is built around a block of land 500 ft. long and 270 ft. wide. The boards are nailed to two lines of 2" $\times$ 4" scantling. Posts are placed 10 feet apart and cost 22¢ each. Find the entire cost of the fence, if lumber is worth \$27 per M.

37. A man who owns a corner lot 33 ft. by 132 ft. decides to build a picket fence on the street sides and a close board fence 4 ft. high on the inside of the lot. The posts cost 25 cents each and are placed 8 ft. 3 in. apart. The pickets, $2\frac{1}{2}$ " wide, are placed 2" apart and cost \$4.40 per 100. Two rows of scantling 2" $\times$ 4" support the pickets and the boards. In the case of the picket fence a base board 12" wide is used, while a rain board costing 3 cents a foot is placed below the pickets. If lumber is worth \$27 per M., find the entire cost of the material, allowing \$2.75 for nails.



38. The above figure represents the end of a shed 20 ft. long, and other dimensions as shown. Find the number of feet of inch lumber required to enclose it.



39. The above diagram represents the end of a canvas tent 10 ft. long and other dimensions as shown. Find the number of square feet of canvas required to make this tent.



CHAPTER VIII

THE METRIC SYSTEM OF WEIGHTS AND MEASURES

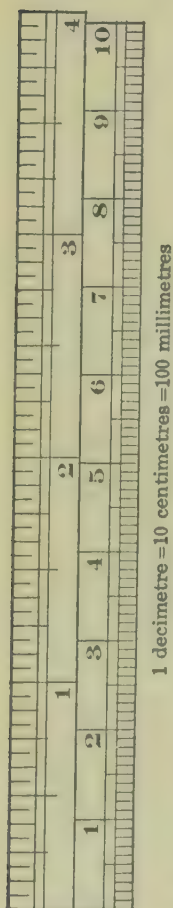
1. In 1795, France adopted a system of weights and measures called the *Metric System*, based upon the decimal system of notation, all the divisions and multiples being by 10. It has since been adopted by most of the nations of Europe and is in partial use in Canada and the United States.

2. *Unit of Length.* The metric standard for measurement of distance is the *Metre*, which is 39.37 inches long, or almost 3 ft. 3 $\frac{3}{8}$ in.

From the metre all other measures of this system are derived, hence the name *Metric System*.

The metre was defined by a law of the French Republic to be the distance between the ends of a rod of platinum made by Borda, the temperature being that of melting ice. It was supposed that this rod represented one ten-millionth part of the distance from the earth's equator to the pole. It has since been found that this is not exactly the case, and thus the metric standard is not the terrestrial globe but Borda's platinum rod.

The annexed diagram represents one-tenth of a metre in length and is called *Decimetre*. It is subdivided into ten equal parts, each of which is called a *Centimetre*, and each of these again into ten equal parts, each of which is called a *Millimetre*.



3. *Unit of Volume.* The unit of volume depends directly on the unit of length. The capacity of a box one-tenth of a metre (a decimetre) long, wide, and deep is the standard unit of measure. Such a measure is called a *Litre*, and is equal to 1761 pints (imperial).

4. *Unit of Weight.* The weight of so much distilled water at a temperature of 4° C. as would fill a measure one-hundredth of a metre (a centimetre) long, wide, and deep is the standard unit of weight and is called a *Gram*.

5. By using Latin and Greek prefixes, denominations higher and lower than the standard, units are formed, the Greek numerals indicating multiples and the Latin ordinals indicating decimal divisions, thus:

Deca	stands for 10	} times the unit.
Hecto	stands for 100	
Kilo	stands for 1000	
Deci	stands for 10th	} part of the unit.
Centi	stands for 100th	
Milli	stands for 1000th	

METRIC TABLES

Measures of Length

The unit is the metre.

10 millimetres (mm.)	= 1 centimetre	= .01 metre
10 centimetres (cm.)	= 1 decimetre	= .1 metre
10 decimetres (dm.)	= 1 metre	= 1. metre
10 metres (m.)	= 1 decametre	= 10. metres
10 decametres (Dm.)	= 1 hectometre	= 100. metres
10 hectometres (Hm.)	= 1 kilometre	= 1000. metres
10 kilometres (Km.)	= 1 myriametre	= 10000. metres

Note. — Metre = $39\frac{3}{8}$ in., nearly; 64 metres = 70 yd. nearly; 1 kilometre = 1100 yd., nearly; 8 Km. = 5 mi., nearly

Cloth, etc., is measured by the metre ; very small distances by the millimetre ; great distances by the kilometre.

A rough rule for converting metres into English yards is to add 10 per cent to them ; thus, 40 metres are equal to 44 yards.

The centimetre is nearly equal to $\frac{4}{100}$ in. ; hence to convert centimetres to inches, multiply by 4 and point off the last figure.

To convert millimetres to inches or decimals of the inch, multiply by 4 and point off the last two figures.

EXERCISE

1. How many metres are there in a decametre? In a hectometre? In a kilometre? How many decametres are there in a hectometre? In a kilometre?

2. What part of a metre is a decimetre? A centimetre? A millimetre?

3. With a metre-stick, or a string one metre in length, measure the height of your desk, the length and width of the schoolroom, the length and width of the platform, the width of the nearest street. Measure the foregoing with a yard measure. Convert the metric measures into feet and inches, approximately, and compare with the actual measurement by these units.

4. Find the value of each of the following expressions in metres :

(a) $.435 \text{ m.} + 825 \text{ cm.} + 4263 \text{ mm.} + 1595 \text{ Km.}$

(b) $.927 \text{ Km.} - 6495 \text{ cm.} ; 4.37 \text{ cm.} - 42.87 \text{ mm.}$

(c) $8 \times .0457 \text{ Km.} ; 38,019 \text{ mm.} \div .097.$

5. Find the cost of 83.75 m. of cloth at \$3.25 per metre.

6. The expense of building a certain railroad is \$25,000 per kilometre. What is the whole cost of the road, if its length is 72 Km. and 53 m. ?

7. The length of the tunnel through Mont Cenis is about 12.22 Km. What is this length in miles, approximately ?

8. The width of the Atlantic is about 3000 mi. What is its width in kilometres ?

9. A train is running at the rate of 48 Km. an hour. How many metres does it travel in a second ?

10. Reduce 27 m. to the fraction of 36 Km.

11. Subtract 31 Km. 3 Hm. 9 m. from 115 Km. 2 Dm. 8 dm.

12. Find the total cost of 75 cm. of cloth at 4 francs per metre, 625 mm. at 8 francs per metre, 60 dm. at 12 francs per metre, and 7 m. 8 cm. at 25 francs per metre.

Measures of Surface, or Square Measure

100 sq. millimetres (sq. mm.) = 1 sq. centimetre
= .0001 sq. metre

100 sq. centimetres (sq. cm.) = 1 sq. decimetre
= .01 sq. metre

100 sq. decimetres (sq. dm.) = 1 sq. metre
= 1 sq. metre = 1 centare

100 sq. metres (sq. m.) = 1 sq. decametre
= 100. sq. metres = 1 are

100 sq. decametres (sq. Dm.) = 1 sq. hectometre
= 10000 sq. metres = 1 hectare

100 sq. hectometres (sq. Hm.) = 1 sq. kilometre
= 1000000 sq. metres

Note. — The are, centare, and hectare are used only in land measure.

The "are" is slightly less than 4 sq. rd.

The "hectare" is slightly less than $2\frac{1}{2}$ A.

Since the scale is 100 (10×10), there are two places for each denomination. Thus 5 hectares, 2 ares, 5 centares is written 5.0205 hectares, or 50,205 square metres.

EXERCISE

1. Write 12 square kilometres as square metres.
2. Write 8 square metres and 35 square decimetres as square metres.
3. A farmer had 5 hectares 5 ares 9 centares of land, and sold first .5 of it, then .3 of it for \$384 an are. What did he get for what he sold? How much had he left?
4. Find in square metres the area of a room 4.53 m. long and 2.75 m. wide.
5. Divide 73 sq. m. by 25.
6. How many square millimetres are there in one square metre?
7. Find the area in square metres of a lot 485 decimetres square.
8. Find the area of a floor 15 m. 68 cm. long and 7 m. 8 cm. 5 mm. wide.
9. A rectangular field has an area of 43 ares 20 centares; its length is 150 m. What is its breadth in metres?
10. A rectangular surface measures 1 sq. m.; it is 1 cm. wide. Find its length.
11. How many bricks each 16 cm. long and 8 cm. wide will be required to pave a walk 24.8 Km. long and 2.4 m. wide?

Measures of Capacity

1000 cu. millimetres (c. mm.)	= 1 cu. centimetre
	= .000001 cu. metre
1000 cu. centimetres (c. cm.)	= 1 cu. decimetre
	= .001 cu. metre = 1 litre
1000 cu. decimetres (c. dm.)	= 1 cu. metre
	= 1 cu. metre = 1 stere

Note. — In measuring wood a cubic metre, called a *Stere*, (St.) is used. $3\frac{1}{6}$ steres = 1 cord, nearly.

In measuring liquids the cubic decimetre, called a *Litre*, is used. Four litres = seven pints, apparently.

In measuring grains, fruits, etc., the hectolitre is used.

The numeral prefixes are used with the litre as with the metre.

EXERCISE

1. Write 5.14 cubic decimeters as cubic metres.
2. Write 8,765,345 cubic centimetres as cubic metres.
3. Add 3 cu. m., 18 cu. dm., 207 cu. cm., 385 cu. m., 230 cu. dm., 895 cu. cm., 10 cu. mm., 831 cu. m., 300 cu. cm. Express the sum in cu. m.; in cu. dm.
4. How many steres of wood are there in a pile 26 m. long, 2.25 m. wide, and 3 m. high?
5. Find the cost of 27.5 Hl. of wheat at \$0.13 per decalitre.
6. How many litres will a rectangular box 1.5 m. long, .72 m. wide, and .84 m. deep hold?
7. How many litres are there in 75 decalitres?
8. A family consumes 2 l. 4 dl. of milk daily. Find the weekly cost at 6¢ per litre.

9. What is the volume of rectangular stone 2 m. long, 8 dm. broad, and 5 dm. 6 mm. thick?

10. How many phials, each holding 2.5 centilitres, may be filled from a vessel containing $2\frac{1}{2}$ litres?

EXERCISE

1. Write in full the table of Dry, or Liquid Measure.
2. Write 4 litres and 8 decalitres as litres.
3. Write 175.4 decalitres as litres.
4. At \$2.00 a litre, what is the price of a centilitre?
5. How much must I pay for 56.25 litres of coal oil at $18\frac{3}{4}\text{¢}$ a litre?
6. How many litres are there in a cubic metre?
7. How many gallons are there in 20 litres?
8. A merchant bought 10 hectolitres of potatoes at \$1 per hectolitre, and sold them at 50¢ a bushel. Did he gain or lose, and how much?
9. How many litres are there in a rectangular tank 3.5 m. long, 2.6 m. wide, and 3.1 m. deep?
10. Taking a pint equivalent to .468 l., how many hectolitres are equal to 3125 bu.?

Measures of Weights

10 milligrams	(mg.) = 1 centigram =	.01 gram
10 centigrams	(cg.) = 1 decigram =	.1 gram
10 decigrams	(dg.) = 1 gram =	1. gram
10 grams	(g.) = 1 decagram =	10. grams
10 decagrams	(Dg.) = 1 hectogram =	100. grams
10 hectograms	(Hg.) = 1 kilogram =	1000. grams

Note. — A cubic centimetre of water at its greatest density weighs one gram. This is the unit of weight.

A gram = $15\frac{1}{2}$ grains, approximately; 28 grams = 1 oz Avoir., approximately.

The gram is used in weighing letters, mixing and compounding medicines, and in weighing all light articles.

The kilogram equals approximately $2\frac{1}{2}$ lbs. Avoirdupois. It is the ordinary unit of weight.

In weighing heavy articles two other weights, the quintal (100 kilograms) and the tonneau or ton (1000 kilograms), are used. The ton is a little less than 2205 lbs.

A litre of water weighs 1 kilogram.

A cubic metre of water weighs 1000 kilograms.

EXERCISE

1. Write 7 kilograms and 18 grams as grams.
2. Write 277 centigrams as grams.
3. Write 12 grams, 2 centigrams and 1 milligram as grams.
4. At \$6 a ton for coal, what will it cost to heat a building 30 days if it takes 400 kilograms of coal a day?
5. How many grains are there in two grams?
6. How many pounds Avoirdupois are there in 976.25 grams?
7. How many grams are there in 12 lbs. Troy? In 12 lbs. Avoir.?
8. The French post-office allows 7.5 grams for a single postage; the Canadian 1 oz. Avoir. By how many grains does the Canadian exceed the French allowance?

REVIEW EXERCISE

1. In a 3-metre square there are how many square decimetres?

2. How many square centimetres are there in an oblong 5 dm. by 6 dm.?
3. The base of a triangle is 9 dm. and the altitude is 64 dm. Find the area.
4. The perimeter of a rectangle is 60 m. and the length is to the breadth as 3 to 2. Find the length, breadth, and area.
5. How many acres are there in a field 72.5 m. by 62.8 m.?
6. A boy rode on his bicycle 2645 m. in 5 min. At this rate how far would he ride in $1\frac{1}{2}$ hr.? Express the answer in kilometres.
7. Divide 16 Hl. of wheat equally among 20 persons. Express the answer in litres.
8. In a right-angled triangle the base and perpendicular are, respectively, 24 dm. and 70 dm. long. Find the hypotenuse.
9. A bin is 12 m. long and 8 m. wide. How deep must it be to hold 1080 Hl. of wheat?
10. Write the following as cubic metres:
 - (a) 47 cu. m., 7 cu. dm., 8 cu. cm.
 - (b) 57 cu. m., 19 cu. dm., 84 cu. cm.
 - (c) 758 cu. m., 78 cu. cm.
11. The total surface of a cube is 2400 sq. m. Find its volume.
12. How many decalitres of water will weigh 18.05 Kg.?

REVIEW EXERCISE

1. Find in miles the length of 10 Km., a metre being 39.37 in.
2. How much is a pile of wood 8 m. long, 4.5 m. wide and 3.4 m. high worth at \$1.25 a stere?

3. Find the cost of 36.8 a. of land when \$750 is paid for 4.25 Ha.

4. The circumference of a wheel is 4.5 m. in length. How many revolutions will this wheel make going 278.1 Km.?

5. How deep must a rectangular box be to hold 30 l. if it is 45 cm. long and 24 cm. wide?

6. What weight of water will fill a vat 96 dm. long, 75 dm. wide, and 42 dm. deep?

7. If alcohol is 80% as heavy as water, find the weight of alcohol in a rectangular vessel 5 dm. by 4 dm. by 24 cm.

8. The circumference of a hoop is 3.8 m. How many times will it turn in rolling a distance of 66.5 dm.?

9. A nickel 5-cent piece weighs 5 g. How many nickels can be made from a bar of coin metal weighing 7 Kg.?

10. How many cubic metres of earth must be removed in excavating a cellar 8.5 m. long, 6.4 m. wide, and 2.2 m. deep?

REVIEW EXERCISE

1. Compare the area of a rectangular field whose length is three times its breadth, and perimeter 1200 m., with the area of a square field whose perimeter is 1000 m.

2. How many ares are there in a rectangular field 75 m. by 66 m.?

3. The diameter of a circle is 371 cm. long. Find its circumference and its area.

4. How much will it cost to paint the curved surface of a standpipe 20 m. high and 8 m. in diameter at 25¢ per square metre?

5. Reduce the following :

(a) 24.7 cu. m. to cubic decimetres.

(b) 1,847,689 cm. to metres.

(c) 87 Hg. to decigrams.

(d) 84 a. to sq. metres.

(e) 5.8 Kg. to centigrams.

(f) 49 sq. m. to sq. centimetres.

6. How many litres will a box hold which is 82 cm. long, 16 cm. wide, and 15 cm. deep?

7. An empty jug weighs 1.04 Kg.; full of water it weighs 3.8 Kg. Find the capacity of the jug in litres.

8. Into how many lots of 4.25 a. may 8 Ha. 5 a. be divided?

9. Find the weight of a bar of iron 50 cm. long, 4 cm. wide, and 2.5 cm. thick, iron weighing 7.8 times as much as an equal volume of water.

10. Express in kilograms the weight of .375 cu. m. of water at its greatest density.

11. A ditch 90 m. long, 75 dm. wide, and 50 dm. deep is full of water. Find the weight of the water in the ditch.

CHAPTER IX

REVIEW

Problems Based on Agriculture, Industry, and Commerce Miscellaneous Problems

EXERCISE

1. Approximately 75% by weight of potatoes is water; the remainder is made up of solid substances. Find the weight of solid substances in a shipment of 5640 bushels.

2. Air weighs .0012 times as much as water. Find the weight of the air in a room 70 ft. long, 35 ft. wide, and 16 ft. high.

3. A schoolroom is 32 ft. long and 28 ft. wide. It has 4 windows, each containing 12 panes of glass 30 inches long and 22 inches wide. Find the ratio of the window area to the floor area.

4. Find the cubic contents of a cubical box, if the area of all its faces is 24,576 square inches.

5. Two men, A and B, hired a pasture field for \$150.00. A put in 75 sheep for 6 months, and B 90 sheep for 5 months. How much of the rent should each pay?

6. A mill was insured for $\frac{2}{3}$ of its value at a premium costing $\frac{5}{8}\%$. If the premium paid was \$77.50, find the value of the mill.

7. A merchant sold flour at \$8.10 per barrel, losing 10%. What would be his gain per cent if he sold the flour at \$9.75 per barrel?

8. I have \$12,000 which I wish to invest. I have two choices: first, investing in Victory Bonds, which pay $5\frac{1}{2}\%$ interest and are exempt from taxation; second, investing in a mortgage which pays 7% interest, the income from which is subject to an income tax of 4% . Which will give the larger yearly income and by how much?

9. A farmer has 83.75 acres of oats, 128.25 acres of wheat, and 45.35 acres of barley. The yields were as follows: oats, 73.5 bushels per acre; wheat, 35.25 bushels per acre; barley, 42.75 bushels per acre. The crop was sold at the following prices: oats, 63 cents per bushel; wheat, \$1.87 per bushel; barley, 98 cents per bushel. Find the total gross returns from the grain.

10. A bankrupt firm makes an assignment with assets of \$36,384.00 and liabilities of \$72,560.00. The cost of settlement is \$3240.00. How much will be paid on the dollar to the creditors?

11. A farmer sold two horses for the same price, \$189 each. On the first horse he gained $12\frac{1}{2}\%$, and on the second he lost $12\frac{1}{2}\%$. Find his net gain or loss.

12. A hardware firm purchased goods listed at \$5460.00 subject to discounts of 25% , 5% , and 2% . Find the net cash price of the goods.

13. I wish to obtain \$500 from the Bank of Commerce. For what sum must I give a note drawn for 90 days, if the bank charges 8% per annum?

14. There are two square pasture fields. The first is 60 rods square, and the area of the first bears the same relation to the area of the second as 1 bears to 4. Find the length of the fence enclosing the second field.

15. A vacant corner lot is 160 ft. long and 120 ft. wide. What distance is cut off by a boy who takes a short cut across the lot from corner to corner rather than walk around both sides?

16. A man insured his house for \$3500, his barn and granaries for \$1250, and his personal property for \$850. The following rates of insurance were paid: On the house and personal property $2\frac{1}{4}\%$, on the barn and granaries $2\frac{5}{8}\%$. Find the total amount of the premium paid.

17. I bought a half section of land, paying for it \$45 per acre. I sowed 120 acres in wheat which cost me the following expenditures: seed, 75 lbs. of wheat per acre at \$2.20 per bushel; putting in the crop, \$4.00 per acre; cutting and stooking, \$3.75 per acre; threshing, 12¢ per bushel; marketing grain, 8¢ per bushel. The yield of wheat was 37 bushels per acre, which I sold for \$1.75 per bushel. The total cost of labor for the season was \$1600. If the money I invested in the land is worth 8% per annum, find my total profit over all expenses, wages, and interest charges.

18. A note drawn for three months for \$850 bearing interest at 9% per annum is made on June 16th, 1919. The note was discounted at the bank on July 8th at 8% . Find (a) date when note is due, (b) proceeds of the note.

19. An ice house is 120 ft. long, 60 ft. wide, and 20 ft. high. Allowing $12\frac{1}{2}\%$ of the total space for sawdust for packing the ice, find the number of tons of ice that may be stored in the building. Water expands 10% in freezing, and 1 cu. ft. of water weighs $62\frac{1}{2}$ lbs.

20. A man bought a house for \$6500. The annual expenditures are: repairs, \$120; taxes, \$72.40; insurance, \$13.60. The house is rented for \$83 per month. What rate of interest does the owner make on his investment of \$6500?

EXERCISE

1. It has been found that a man who has not received a high school education is able to earn an average of \$748.00 a year over a period of 40 years. A man who has received a four-years' high school training is able to earn on an average of \$1245 per year over a period of 40 years. If the high school term is 180 days a year, find the value in increased earning power of each day spent in high school.

2. The price of gas for domestic use is 35 cents per thousand cubic feet, with a discount for cash of 10%. The reading of the metre on March 1st was 57,400 cubic feet; on April 1st the reading was 63,200 cubic feet. Find the amount I shall have to pay, if I take the discount for cash.

3. I bought a stock of hardware, the list price of which was \$15,000. I secured on this two discounts of $33\frac{1}{3}\%$ and 15%. I sold the goods at an advance of 10% on the list price. If the cost of handling the goods was 5% of the net cost, what per cent gain did I make on the stock?

4. A man sold some horses and cattle. He was offered \$2400 cash or \$2650 on a note due in 6 months without interest. He accepted the second offer and immediately discounted the note at the bank at 8% discount. How much more in cash did he receive by accepting the second offer?

5. On November 3rd I borrowed from the bank \$750, giving to the bank my note for 90 days. The bank charged interest at the rate of 8% per annum and deducted the interest in advance from the amount borrowed. What amount of money does the bank give me on the note?

6. A boy deposits in the savings bank on January 1st, 1918, the sum of \$25; on July 1st, he deposits another amount of \$25; on January 1st, 1919, he again deposits

\$25. The bank adds interest to what he has on deposit on June 30th and December 31st at the rate of 4% per annum. How much has he to his credit on July 1st, 1919?

7. A silo which is in the shape of a cylinder is 14 feet in diameter and 35 feet high. Find the number of acres of green oats and peas required to fill the silo, allowing 40 lbs. to the cubic foot, the yield of green feed being 14 tons per acre.

8. A water tank is 12 feet long, 2 feet wide, and 3 feet deep. Find the cost of lining the inside of the tank with zinc which is worth 19 cents per lb., if 1 lb. of zinc is allowed to every 2 square feet.

9. A farmer has 15 dairy cows which produce an average of 27 lbs. of milk daily during the months of June, July, and August. He sells the milk to a dairy which pays him 49 cents per lb. butter fat. If the milk tests 3.95% butter fat, find the total amount of money he received from the milk during the three months.

10. A man bought a house, paying for it \$5600. The taxes on the house are \$65 per year, insurance \$15 per year, repairs \$150 per year. What rate of interest does the owner make on his investment of \$5600, if he rents the house for \$45 per month?

11. Three men form a partnership in a hardware store. The first man invests \$2500 in the business, the second man \$3500, and the third \$3000. At the end of the year the profits amount to \$2700. How much should each receive?

12. A commission merchant received \$375 as his commission for purchasing 2500 barrels of flour. If his rate of commission is $2\frac{1}{2}\%$, find the price paid per barrel for the flour.

13. A man owns a herd of 28 dairy cattle. He feeds them ensilage for 150 days at the rate of 40 lbs. per day per cow. If 1 ton of ensilage requires 44 cubic feet of space, find what must be the height of a silo whose diameter is 14 feet which will be required to store the feed.

14. A park 360 feet wide and 600 feet long is prepared for grass. It is filled in with earth to a depth of 10 inches, and a dressing of black earth to a depth of $2\frac{3}{4}$ inches is put on the top. Find the cost of preparing the lawn, if the earth is worth 75 cents a load and the black earth for dressing is worth \$1.35 per load. A load of earth contains 1 cubic yard.

15. A water tank, which is in the form of a cylinder with a diameter of 12 feet, is filled at the rate of 180 gallons per minute. What will be the depth of the water in the tank at the end of 45 minutes? 1 cubic foot of water contains $6\frac{1}{4}$ gallons.

16. Find the net return per acre from a field of wheat, using the following data :

- (1) Interest on money invested in the land at 8%. Cost of the land \$40 per acre.
- (2) Preparation of the land for crop at \$7.50 per acre.
- (3) Seed at \$2.20 per bushel, using 75 lbs. per acre.
- (4) Cutting grain at \$1.35 per acre.
- (5) Stooking the grain at \$0.75 per acre.
- (6) Twine, $2\frac{1}{2}$ lbs. to the acre, at 16 cents per lb.
- (7) Threshing at 12 cents per bushel.
- (8) Hauling grain to the elevator at 6 cents per bushel.
- (9) Freight to Fort William at 25 cents per cwt.
- (10) Commission for selling the wheat 1 cent a bushel.
- (11) Selling price of the wheat at Fort William \$2.15 per bushel.
- (12) Average yield per acre 27 bushels.

17. A stream of water is 40 rods wide and flows at the rate of 5 miles per hour. If the average depth of the stream is 4 ft., find the number of gallons of water that may be withdrawn from the stream per minute, if only $\frac{1}{4}$ of the water may be taken from the stream. 1 cubic foot of water contains $6\frac{1}{4}$ gallons.

18. A farmer has 168 acres in wheat. He expects a yield of 40 bushels per acre. How many bins each 15 feet long 10 feet wide, and 7 feet high must be built to store the grain, allowing $1\frac{1}{4}$ cubic feet of space per bushel?

19. A man owns 4 square lots which adjoin each other, all facing on the same street. If the area of one lot is 2209 square yards, find the cost of fencing the outside of the 4 lots at 35 cents a foot.

20. A man shipped 2 carloads of stock to the Winnipeg stockyards. In the first car there were 18 head which averaged in weight 1120.62 lbs. In the second car there were 24 head which averaged in weight 1098.76 lbs. The cattle were sold at \$7.75 per cwt. Find the total amount received for the cattle. If a commission of 1% were paid for selling the cattle, find the net amount received on the shipment.

EXERCISE

1. How many acres of green feed will produce the silage to feed 16 cows, 30 pounds each of silage per day during the months of Jan., Feb., and Mar., if each acre yields 12 tons of silage?

2. A farmer, using a plow which turns two furrows each 14 inches wide, plows 16 rounds per day in a field 160 rd. long. If he receives \$4.50 per acre, how much does he earn during the 50 days he worked in June and July?

3. A courtyard is 5.5 metres wide and 6.3 metres long. How many bricks each 21 cm. long and 11 cm. wide will be required to pave it?

4. A farmer had a field of wheat 320 rd. long and 160 rd. wide. The average yield was 35 bushels per acre. It cost \$4.80 per acre to work the land, \$3.50 per acre for seed wheat, \$2.25 per acre to harvest, and 11¢ per bushel to thresh and market. Find the farmer's profit from the field of wheat, if he sold the wheat at \$1.85 per bushel.

5. A body of British soldiers dug a trench $2\frac{1}{2}$ miles long. The trench had an average depth of 5 ft. 4 in. and an average width of 3 ft. 6 in. How many cubic yards of earth were removed?

6. In a town a cylindrical water tank 42 ft. in diameter is lowered 6 ft. in $4\frac{1}{2}$ hours when no water is being pumped into it. How many gallons of water are used in this town per hour?

7. A wagon wheel is 14 ft. 6 in. in circumference. How many revolutions will it make in going 9 miles?

8. How many cubic feet of concrete are there in a retaining wall 75 ft. long, 12 ft. high, 4 ft. wide at the bottom and 2 ft. wide at the top?

9. A lead pencil is 8 inches long and $\frac{1}{4}$ of an inch in diameter. The lead in the pencil is $\frac{1}{16}$ of an inch in diameter. Find the number of cubic inches of wood in the pencil.

10. A fence around a square field costs \$84 at 35¢ per rd. What would be the cost of the fence, if this field had been rectangular in shape with a width of 40 rd.?

11. A room is 18 ft. long, 12 ft. wide, and 10 ft. high. What will it cost to plaster the room at 30¢ per sq. yard, making deductions for two doors each 7 ft. high and 4 ft. wide, and 3 windows each 6 ft. high and 3 ft. wide, and an 8-inch baseboard?

12. A board $2\frac{1}{2}$ inches wide, when tongued and grooved, covers 2 inches of floor space. In estimating the number of feet of flooring required for a room, what part of the area of the floor space must you add to the floor space in order to get the correct estimate of the number of feet of flooring required?

13. A man can buy for \$75 a grade cow that gives 32 lbs. of milk per day, or for \$125 a Jersey cow that gives 27 lbs. of milk daily. The grade cow's milk tests 3.75% butter fat and the Jersey's 5% butter fat. If the market price of butter averages 40¢ a pound during the year, which is the better investment? What per cent profit would each cow yield on the investment?

14. If a clean field of oats yields 70 bushels per acre, and a weedy field yields only 50 bushels per acre, what is the loss per cent caused by weeds, when the market price of oats is 60¢ per bushel?

15. Two boys leave the public school, one to work as an unskilled laborer at \$2.50 per day; the other borrows \$600 which he pays back at the end of 4 years with interest at 6%, and goes away to a trade school for 3 years. He learns a trade by means of which he can earn \$8.00 per day. Each boy is able to average 275 working days a year. At the end of 10 years from the time they leave the public school, how much money has the first boy earned, and how much has the second boy earned over and above the amount borrowed with interest which he paid out of his earnings?

16. If 10 inches of snow make one inch of water, and the average depth of snow on a section of land is 18 inches, find the number of cubic feet of water on the section.

17. A man bought a farm 3 Km. long and 2.5 Km. wide. Find the cost of fencing the farm at 10¢ per metre.

18. A farmer insured his house for \$2700 at a premium of $1\frac{1}{4}\%$, his barn for \$1200 at a premium of $\frac{7}{8}\%$, and 6400 bushels of wheat at \$2.25 per bushel at a premium of 1%. Find the amount of premiums paid by the farmer for this insurance.

19. A tea importer buys 3 tons of tea at \$26 per cwt. The duty on the tea is $33\frac{1}{3}\%$. Freight and other charges are \$120. He sells the tea at 55¢ per lb. Find his gain per cent.

20. A merchant bought paper at \$3 per ream and sold it at 25¢ per quire. What per cent gain did he make?

EXERCISE

1. A fruit-grower shipped 200 dozen ten-pound boxes of cherries to Vancouver, where they were sold by a commission agent at \$1.20 per box. Picking and packing the fruit cost $1\frac{1}{2}$ cents per lb., freight and shipment charges were \$35.00, and the agent's commission was 4%. Find the net amount received by the fruit grower.

2. Find the cost of sending the following telegrams at 25 cents for the first 10 words and 1 cent for each additional word:

(a) 22 words. (b) 45 words. (c) 68 words.

3. What will be the charge for using a long distance telephone, if the telephone charges are 45 cents for the first 3 minutes and 10 cents for each additional minute:

(a) Conversation for 7 minutes?
(b) Conversation for 11 minutes?
(c) Conversation for 14 minutes?

4. A coal bin 10 feet long and $7\frac{1}{2}$ feet wide has 15 tons of coal stored in it. If 1 ton of coal requires 35 cubic feet of space, find the height of the coal in the bin.

5. Mark the following goods which cost as indicated, so that there will be a profit of $33\frac{1}{3}\%$ after giving the indicated discount :

(a) Cost \$288, discount off marked price 10%.

(b) Cost \$378, discount off marked price 20%.

(c) Cost \$960, discount off marked price $16\frac{2}{3}\%$.

6. A farmer bought a farm 1 mile long and $\frac{5}{8}$ of a mile wide at \$47.50 per acre. He broke all the land and sowed it in wheat, using 75 lbs. of seed to the acre. The following were his expenses: preparing the ground for crop, \$3.00 per acre; seed, \$2.20 per bushel; cutting and stooking, \$1.75 per acre; binder twine, \$125.00; threshing, 12 cents per bushel; hauling to elevator, 6 cents per bushel. The crop averaged 28.75 bushels per acre, which was sold at \$1.65 per bushel. If money is worth 8% per annum, and the farmer had his money invested in the farm for two years before securing a crop, find the average net profit per year for the two years.

7. A farmer, by feeding his cows \$3.50 worth of bran more per day than he had been feeding, increased the percentage of butter fat from 3.5% to 3.69% and increased the daily yield from 2325 lbs. to 2475 lbs. If he sells the milk at 52 cents per lb. butter fat, how much did he gain per day by the increased feeding?

8. Find the square root of each of the following numbers :

(a) 9456.76

(b) 32.7184

(c) 192.16834

9. Find the cost of carpeting a room 18 feet long, 14 feet 6 inches wide, with carpet 18 inches wide at \$3.25 per yard,

allowing 7 inches additional length on each strip but the first for matching the pattern. The carpet is laid lengthwise in the room.

10. A man borrows a sum of money from the Standard Bank and gives in payment his note for \$650 due in 90 days. If the bank charges in advance 8% per annum for money loaned, find the amount received by the man from the bank.

11.

\$ 435.00

Portage La Prairie, Manitoba,
March 7th, 1919

.....Six months.....after date,---I---promise to pay to the
Massey Harris Co. Ltd., ...at the
.....Union Bank of Canada, Portage La Prairie.....
the sum of Four Hundred and Thirty-Five $\frac{00}{100}$ Dollars
with interest at 9% per annum.

Value received.

Robert Jones.

This note was discounted at the bank on April 15th, the discount rate being 8% per annum. Find (1) the date when this note is due, (2) the proceeds of the note on April 15th.

12. The area of the floor of a schoolroom, the length and width of which are the same, is 841 square feet. Find the number of square feet of blackboard space required for a blackboard along 2 sides of the room, the blackboard being 4 feet high.

13. A school district borrowed on debentures \$1200, agreeing to pay back the principal in 5 equal annual payments, together with interest at $6\frac{1}{2}\%$ per annum. Find the amount of each of the 5 annual payments of principal and accrued interest.

14. A hardware salesman is paid \$125 a month and a commission of $2\frac{1}{2}\%$ of his sales. Find what his yearly income will be, if his sales for the year amounted to \$98,500.

15. A merchant sold flour which cost him \$2400 at a profit of 18% ; he sold sugar which cost him \$3550 at a profit of 20% ; rice which cost \$1800 he sold at a profit of 16% ; and soap which cost \$3200 at a profit of 7% . What was his gain per cent on the sale of all these articles?

16. A firm insures its property in three companies; in the first for \$5000, in the second for \$7500, and in the third for \$6000. A fire occurs, and the loss is \$4200. What amount of the loss should each company pay?

17. The regulations of a city require all milk sold by dairies to test 4.556% butter fat. A dairy which distributes 250 gallons of milk in the city has shipped to it two consignments of milk testing respectively 3.75% butter fat and 5.3% butter fat. How much of each of these shipments can be used in a mixture by the dairy to supply 250 gallons at the legal test of 4.556% butter fat?

18. A dealer imports the following goods from the United States: 3 dozen ladies' shoes listed at \$85 per dozen, 5 dozen men's shoes listed at \$78 per dozen, and 2 dozen leather travelling bags listed at \$12 each. The duty on these goods is $33\frac{1}{3}\%$. If freight charges are \$35, find the cost of the goods to the dealer.

19. In 1917, Ontario produced 3,495,000 lbs. of tobacco from 2930 acres. In 1918, 6,649,500 lbs. were grown from 6500 acres. (a) Find the average yield per acre for each year. (b) Find the increase per cent of the total tobacco production of 1918 over the year 1917.

20. A man sold his farm for \$18,400. He paid the real estate firm for selling the farm a commission of 5% on \$5000 of the sale, and 1% on the remainder. The man invests the proceeds from the farm in mortgages which pay 9% interest per annum. If he pays an income tax of 4% on the interest from the mortgage, find his net yearly income.

EXERCISE

1. The average temperatures of the Province of Ontario in 1918 were as follows: January, 15.2° ; February, 13.6° ; March, 27.8° ; April, 41.5° ; May, 53.2° ; June, 61.4° ; July, 68.8° ; August, 68.4° ; September, 59.8° ; October, 47.7° ; November, 33.6° ; December, 28.3° . (a) Find the average temperature for the year. (b) Find the average temperature for the summer months, June, July, and August.

2. The assessed value of the property of a town is \$2,496,000. The estimated expenditures for the year are as follows: streets and public works, \$8600; schools, \$6400; hospitals, \$2500; miscellaneous, \$2452. (a) Find the mill rate that will be required to be levied to meet these expenditures. (b) W. H. Brown is assessed on land for \$2200 and on a building for \$6550. Find the amount of his taxes.

3. The diameter of a bicycle wheel is 28 inches. Find the number of revolutions it makes in going 1 mile.

4. A baseball diamond is 90 ft. square. Find the distance between two diagonally opposite corners.

5. Construct an isosceles triangle with a base 8 inches long and each of the equal angles at the base 60° . Find the area of this triangle.

6. Find the area of the curved surface of a cylindrical standpipe which is 28 ft. in diameter and 60 ft. high.

7. A man's yearly income is obtained from the following sources: salary, \$2700; interest from mortgages, \$375; interest on Victory Bonds exempt from taxation, \$550; rent from house, \$225. He pays a Federal Income Tax of 4% on all his income over \$2000, with the exception of his income from Victory Bonds. Find the amount of his net income.

8. At a sale a man bought \$375 worth of stock. He has the option of paying cash and receiving a discount of 5%, or giving his note due in six months bearing interest at 8% per annum. If the man can make 8% on his money, which is the better settlement for him to make, and by how much?

9. Five men form a company investing the following amounts: A, \$3500; B, \$4200; C, \$3600; D, \$4000; and E, \$4500. If the profits for the year were \$4200, find the share of each man.

At the end of the first year A bought out the shares of D and E. The second year the business paid a profit of 25% of the capital invested. Find the amount each person should receive at the end of the second year.

10. A school district is 5 miles long and $4\frac{1}{2}$ miles wide. The expenditures were estimated as follows: debenture payment, \$529; teacher's salary, \$1200; salary of the secretary-treasurer, \$75; fuel and supplies, \$160. The

government grant is \$200 per year. Find the rate of taxation in cents per acre which must be levied to meet the expenses of the district.

11. Simplify :
$$\frac{36\frac{3}{7} - 2\frac{8}{21}}{\frac{5}{9} + 2\frac{2}{3} - \frac{3}{6} \text{ of } \frac{17.5}{12} \text{ of } \frac{5}{9} - 2\frac{5}{8}}$$

12. A school rink is 160 ft. long and 104 ft. wide. The ice is 8 inches thick. If water expands $\frac{1}{10}$ of its volume in freezing, find the number of gallons of water required for the rink. (1 cu. ft. of water contains 6.25 gallons.)

13. A real estate agent charges the following commissions : Farm lands, 4% of total sales ; city property, 5% on \$1000, and $2\frac{1}{2}$ % on all sums over that amount. The sales for one week were as follows : 1 quarter section of land at \$37.50 per acre, 1 house and lot in Regina at \$6400, 1 section of wheat land at \$65 per acre, 1 half section of land at \$21.50 per acre, 1 house and lot in Moose Jaw at \$4500. Find the total commissions for the week.

14. A man buys a threshing outfit, making the following investments : separator, \$1830 ; engine, \$4200 ; tank and wagon, \$180 ; cook car, \$160. He hires the following help : 4 men with teams at \$8 each per day, 1 tank man at \$7 per day, 1 separator man at \$8.50 per day, 1 engineer at \$8.00 per day, 1 cook at \$6.00 per day. He had a run of 30 days during which he threshed 26,231 bushels of wheat, charging 12¢ per bushel ; 24,319 bushels of oats, charging 7¢ per bushel ; 14,994 bushels of barley, charging 9¢ per bushel. He uses $1\frac{1}{2}$ tons of coal per day for which he pays \$6.50 per ton. It costs him \$12 per day to pay for the food of his men. He allows 20% of the cost of his equipment for the year's depreciation. If he charges against the returns, the depreciation charges and a year's interest at the rate of

8% on his original investment, find how much he has made on the season's threshing.

15. A man wishes to set out an orchard of 1521 fruit trees, so that the number of trees in the length and breadth of the orchard will be the same. The trees are placed 25 ft. apart. How many acres of land will be required for the orchard?

16. A man bought 320 acres of land at \$65 per acre. He paid \$5400 cash and arranged to pay the balance in *four* equal annual payments together with interest at 6% per annum. Calculate the amount of each of the *four* annual payments.

17. The capital invested in the building and equipment of a furniture factory is \$250,000. The profits for one year are \$175,025. The amount paid to employees in wages is \$375,250. From the profits an amount equal to 15% of the capital invested in building and equipment is set aside to pay depreciation. The shareholders are paid at the rate of 40% per annum on the capital invested, and the balance of the profits are distributed among the employees in proportion to the amount of the wages. (a) Find by what per cent the wages are increased from sharing in the profits. (b) Find the share of profits received by a man whose wages are \$1325 per year.

18. A 60-day note for \$450.00 was discounted at 8% on April 18th. The proceeds amounted to \$446.23. Find (a) in how many days from April 18th, the note would be due; (b) the date when the note is due; (c) on what date the note was drawn.

19. A commission agent received a consignment of 2400 barrels of flour which he sells at \$8.75 per barrel on a commission of 4%. Freight charges amounting to \$325 and storage charges of \$75 are deducted, and the balance is

remitted to the shipper. How much did the agent remit from the sale of the flour?

20. An importer of Montreal bought in England cotton goods invoiced at \$12,345.00. The duty on these goods is $27\frac{1}{2}\%$. Shipment charges were \$228.00. At what price must the goods be sold to realize a profit of 25% on the entire cost of the goods?

APPENDIX

TABLES OF WEIGHTS AND MEASURES FOR REFERENCE

Avoirdupois Weight

16 drams (dr.)	= 1 ounce	or 1 oz.
16 ounces	= 1 pound	or 1 lb.
100 pounds	= 1 hundredweight, 1 cental or 1 cwt.,	
20 hundredweight	= 1 ton	or 1 T.

Note. — In Great Britain 112 lbs. make a hundredweight, and 2240 lbs. make a ton, called the long ton.

Long Measure

12 inches (in.)	= 1 foot	or 1 ft.
3 feet	= 1 yard	or 1 yd.
5½ yards	= 1 rod	or 1 rd.
40 rods	= 1 furlong	or 1 fur.
8 furlongs	= 1 mile	or 1 mi.

1 mi. = 320 rd. = 1760 yd. = 5280 ft. = 80 chains

Note. — Gunter's chain is used in measuring land. It is 22 yards in length, and is divided into 100 links, each link being 7.92 inches long.

<i>Note.</i> — 6 feet		1 fathom
120 fathoms		1 cable length
880 fathoms		1 mile

Note. — The hand (the breadth of the hand and thumb) used in measuring the height of horses at the shoulder is 4 inches.

4840 sq yds = 1 A.
 43560 sq ft = 1 A.

APPENDIX

Surface Measure

144 square inches (sq. in.) = 1 square foot or 1 sq. ft.

9 square feet = 1 square yard or 1 sq. yd.

$30\frac{1}{4}$ square yards = 1 square rod or 1 sq. rd.

160 square rods = 1 acre or 1 A.

640 acres = 1 square mile or 1 sq. mi.

Note. — 10,000 square links = 1 square chain

10 square chains = 4840 sq. yds. = 1 acre

160 A. = a quarter-section land | 640 A. = a whole section land

320 A. = a half-section land | or 1 sq. mi.

36 sections = 1 township (tp.)

Cubic, or Solid Measure

1728 cubic inches (cu. in.) = 1 cubic foot or 1 cu. ft.

27 cubic feet = 1 cubic yard or 1 cu. yd.

128 cubic feet = 1 cord or 1 cd.

Measure of Capacity

2 pints (pt.) = 1 quart or 1 qt.

4 quarts = 1 gallon or 1 gal.

2 gallons = 1 peck or 1 pk.

4 pecks = 1 bushel or 1 bu.

1 cu. ft. of water weighs 1000 oz. and contains $6\frac{1}{4}$ gal.

The following table gives the weight of a bushel of the article named :

Lime	80 lbs.	Rye	56 lbs.
Bituminous coal . .	70 lbs.	Flax seed	56 lbs.
Beans	60 lbs.	Onions	50 lbs.
Clover seed	60 lbs.	Barley	48 lbs.
Peas	64 lbs.	Buckwheat	48 lbs.
Potatoes	60 lbs.	Timothy seed . . .	48 lbs.
Turnips	50 lbs.	Hemp seed	44 lbs.
Carrots	50 lbs.	Castor beans . . .	40 lbs.
Parsnips	45 lbs.	Malt	36 lbs.
Beets	50 lbs.	Oats	34 lbs.
Wheat	60 lbs.	Blue grass seed . .	14 lbs.
Indian corn	56 lbs.		

Measure of Time

60 seconds (sec.)	= 1 minute	or 1 min.
60 minutes	= 1 hour	or 1 hr.
24 hours	= 1 day	or 1 da.
7 days	= 1 week	or 1 wk.
12 calendar months or 365 days	= 1 year	or 1 yr.
366 days	= 1 leap year	

Circular, or Angular Measure

60 seconds (")	= 1 minute or 1'
60 minutes	= 1 degree or 1°
360 degrees	= 1 circumference or 1 C.

English, or Sterling Money

4 farthings (far.)	= 1 penny	or 1d.
12 pence	= 1 shilling	or 1s.
20 shillings	= 1 pound	or £1

Note. — £1 sterling = \$4.86 $\frac{2}{3}$, and 1s. = 24 $\frac{1}{2}$ cents.

1 guinea = 21 shillings

Miscellaneous Table

12 units = 1 dozen	or 1 doz.
12 dozen = 1 gross	or 1 gro.
12 gross = 1 great gross	
20 units = 1 score	or 1 sco.
24 sheets = 1 quire	or 1 qr.
20 quires = 1 ream	or 1 rm.
196 lbs. flour = 1 barrel	or 1 bbl.
200 lbs. pork = 1 barrel	or 1 bbl.

Folded note paper is sold 480 sheets to the ream; other papers for commercial purposes run 500 sheets to the ream.

Freezing point of water, on Fahrenheit scale, 32° above zero.

Boiling point of water, under a pressure of 760 mm., 212° F.

A board foot is 12 in. × 12 in. × 1 in.

A bunch of shingles contains 250. A thousand shingles are reckoned to cover 100 sq. ft.

Light travels at the rate of 186,000 mi. a second.

Sound travels in the air at the rate of 1100 ft. a second.

An imperial gallon contains 277.274 cu. in.

The wine gallon contains 231 cu. in. 6 wine gallons = 5 standard gallons.

A bushel contains 8 imperial gallons.

The long ton is used in the United States custom houses and in wholesale transactions in iron and coal.

Atmospheric pressure. At the level of the sea the pressure of the atmosphere is about 14.7 lbs. per square inch.

The barometer. The column of mercury falls about an inch for each 1000 ft. of ascent.

A *brick* is 8 in. long, 4 in. wide, and 2 in. thick. Approximately 22 bricks and the mortar will fill 1 cu. ft.

A *lath* is 4 ft. long and $1\frac{1}{2}$ in. wide. They are usually left $\frac{3}{8}$ in. apart when nailed. There are 50 laths in a bunch. A bunch will cover 3 sq. yd. of surface.

Wall paper in America is 18 in. wide and is put up in double rolls 16 yds. long. English wall paper is usually 21 in. wide.

ANSWERS

Exercise. Page 9. 9. \$14,158. 10. (1) By Rail 31,653. 614 bushels; (2) By Vessel 126,189, 621 bushels; (3) Total 157,843,235 bushels. 11. 38,192 miles. 12. 121,877,128 tons. 13. 14,-015,588 tons. 14. \$3,173.52. 15. \$133,493.91. 16. 26,186,-000 acres; 735,798,000 bushels. 17. (1) 695,221 boys; (2) 691,501 girls; (3) Total 1,386,722.

Exercise. Page 14. 5. \$2040.14. 6. 2,447,820 cattle.

Exercise. Page 19. 1. Manitoba \$76,744,239; Saskatchewan \$220,512,831; Alberta \$99,095,227; Total \$396,352,297. 2. \$19,250,000. 3. \$6,592,560.72. 4. \$104.13. 5. Gain \$315. 6. Gain \$2318.75. 7. (1) \$2304 (2) \$10360 (3) \$8056 (4) \$50.35. 8. \$52.75. 9. \$48,283,315.00. 10. (1) Ontario \$70.68, Quebec \$81.95, N. S. \$81.78, N. B. \$92.16, P.E.I. \$52.44, Man. \$55.04, Sask. \$74.80, Alta. \$62.48, B. C. \$111.15; (2) $136\frac{2}{3}$ bush.; (3) $57\frac{7}{8}$ c. (4) \$75.83 $\frac{1}{9}$.

Exercise. Page 21. 8. 198 yds. 2 ft. 3 in. 9. 24 ft. 10 in. 10. 3168 steps. 11. 66 lots. 12. 600 poles.

Exercise. Page 23. 6. 24 quarter-sections. 7. 11,520 acres. 8. 18,000 sheets. 9. 20 sq. yds.; \$30.00. 10. Length 80 rods.

Exercise. Page 24. 7. 4500 gallons. 8. 196 loads. 9. $1\frac{1}{2}$ cords; \$8.40. 10. 3 tons.

Exercise. Page 25. 6. 144 bottles. 7. \$57.60. 8. 13,500 gallons. 9. \$56.70. 10. \$196.56.

Exercise. Page 26. 4. 64 tons, 1024 lbs. 5. 11,343 tons, 15 cwt. 6. \$410.25. 7. \$298.94. 8. \$2887.50.

Exercise. Page 27. 1. \$309.72. 2. \$486.45. 3. Potatoes 117 bush.; turnips 123 bush.; beans 98 bush.; 4. \$330.45.; 5. 75,000 tons.

Exercise. Page 28. 1. 166 days. 2. 218 days. 3. 1232 hours; \$800.80. 4. 94 days. 5. 5 hours 40 minutes. 6. 28 hours 45 minutes.

Exercise. Page 29. 1. 2 quires; 6 quires; 9 quires. 2. 2160 pencils. 3. 4320 eggs. 4. 5 oranges. 5. \$2.70. 6. \$12.00. 7. \$7.90. 8. \$32.00.

Exercise. Page 31. 7. 6 weeks 3 days 6 hours 50 min. 33 sec. 8. 11 yards 1 foot 10 inches. 9. 101 miles 1261 yards. 10. 1395. cords 124 cu. ft. 11. 458 bush. 49 lbs. 12. 99 acres 4488 sq. yds. 6 sq. feet.

Exercise. Page 32. 6. 143 bu. 7. 31 gal. 2 qt. 1 pt. 8. 12 sq. yds. 3 sq. ft. 132 sq. in. 9. 1 cwt. 85 lbs. 10. 72 miles 254 rods.

Exercise. Page 33. 1. 4 acres 405½ sq. yd. 4 sq. ft. 2. 1 hour 35 min. 45 sec. 3. 62° 49' 4". 4. 9 acres 353½ sq. yd. 5. 1 bushel 1 pk. 1 gal. 6. 4 tons 1323 lbs. 7. 8 yd. 2 ft. 3 in. 8. 114 cords 11 cu. ft. 9. 500 gallons. 10. 97 miles 842 yds. 2 ft. 6 in.

Exercise. Page 35. 3. 8 min. 59 sec. 4. 123 yds. 1 ft. 8 in. 5. 2625 lbs. 6. 88 acres. 7. 738 miles 992 yds. 8. 89 ft. 11 inches. 9. 2 feet 10 inches. 10. 91 gal. 2 qts. 11. \$27.00.

Exercise. Page 37. 1. 25 jars. 2. 1 foot 8 inches. 3. 6 miles. 4. 24 barrels. 5. 4 miles 328 yds. 6. \$160.00. 7. 25 miles. 8. 165 tons. 9. \$4125.

Exercise. Page 40. 1. (a) 24 (b) 24 (c) 6 (d) 21 bd. ft. 2. 288 bd. ft. 3. 2400 bd. ft. 4. 2232 bd. ft. 5. 1188 bd. ft. 6. 3000 bd. ft. 7. \$332.00. 8. \$18.00. 9. 3600 bd. ft. 10. \$315.

Exercise. Page 41. 1. 32 sq. yds. 2. 150⅔ sq. yds. 3. \$37.80. 4. 36 feet. 5. 824 sq. ft.: 1292 sq. ft. 6. \$44.00. 7. \$5.00. 8. 80 yds. 9. \$29.40. 10. \$42.00.

Exercise. Page 43. 1. 141 yds. 2. 544 sq. ft. 3. 112 yds. 4. \$14.00. 5. 44 rolls.

Exercise. Page 44. 8000 shingles. 2. 24,000 shingles. 3. 20,000 shingles. 4. 10 feet. 5. \$105.30. 6. \$40.00. 7. \$28.80. 8. 115⅓ bundles. 9. \$123.50.

Exercise. Page. 45. 1. \$41.42. 2. \$591.24. 3. \$27.15. 4. \$268.00. 5. \$785.20. 6. \$3345. 7. \$160.20. 8. \$6553.50.

Exercise. Page 48. 1. Balance due \$185.70. 2. Balance due \$1.95. 3. Balance due \$33.80. 4. Balance due \$43.37. 5. Balance due \$1556.31.

Exercise. Page 50. 1. 36 mi. 2. \$17338.05. 3. Contents
10648 cu. in. 4. 495 miles. 5. \$10561.42. 6. \$58.50.
7. \$43.75; \$100.00. 8. \$472. 9. \$3685.50. 10. \$20.35.

Exercise. Page 52. 1. \$674,325.00. 2. \$2106.00. 3. \$51.30.
4. 1st boy \$645; 2nd boy \$1326; \$170.25. 5. 7 days. 6. \$1323.03.
7. \$73.70. 8. By carload cheaper by \$8.64½.

Exercise. Page 53. 1. 38 lbs. 3½ oz. 2. 224 cu. ft. of air
space. 3. \$46.07½. 4. \$309.67 5. Area of floor 288 sq. ft.;
\$72.00. 6. 11 ft. 7. 150 bush. per acre. 8. \$137,871,757.12.
9. \$40.98.

Exercise. Page 54. 1. (a) 238½ yds.; (b) 831½ yds.; (c) 1926 yds.
2 ft.; (d) 5093 yds. 1 ft. 2. (a) 1016 rds. 5 yds. 1 ft.; (b) 880 rds.
3. 5 mi. 96 rds. 5 yds. 1 ft. 4. (a) 15 ac. 140 sq. rds. 5 sq. yds.
(b) 10 ac. 70 sq. rds. 5. (a) 5940 yds. (b) \$1247 40. 6. 960 bush.
7. 4537 tons 10 cwt. 8. \$103.40. 9. 27½ miles. 10. 170 days.

Exercise. Page 56. 1. 119,790 cub. ft. 2. \$17,108. 3. \$940;
\$380. 4. \$378. 5. \$49.00. 6. 1 mile 3680 feet. 7. \$14.28.

Exercise. Page 62. 1. 2½⁷/₁₀₀ lbs. 2. \$123.12. 3. 100 acres; (a) 27½ ac.
(b) 16¼ ac.; (c) 13¾ ac.; (d) 22½ ac. 4. 6⅞ tons. 5. 23⅛ inches.
6. 37½ miles. 7. 12,000 ft. 8. 4½ lbs.

Exercise. Page 64. 1. $\frac{3}{5}$, $\frac{7}{11}$, $2\frac{1}{9}$, $\frac{33}{41}$, $1\frac{1}{5}$, $\frac{29}{35}$, $\frac{26}{19}$. 2. $\frac{2}{3}$, $\frac{57}{64}$, $1\frac{21}{275}$,
 $\frac{10}{11}$, $\frac{69}{85}$, $\frac{82}{87}$. 3. 16. 4. $\frac{3}{4}$. 5. $\frac{5}{9}$. 6. $\frac{3}{26}$. 7. $1\frac{7}{9}$. 8. $1\frac{52}{75}$.
9. $4\frac{4}{5}$. 10. $\frac{26}{49}$. 11. $1\frac{14}{17}$. 12. 2. 13. $2\frac{3}{4}$. 14. $2\frac{8}{7}$. 15. $\frac{2}{23}$.
16. $1\frac{7}{29}$. 17. $\frac{2}{15}$. 18. $\frac{53}{32}$. 19. $\frac{31}{23}$. 20. $\frac{465}{632}$. 21. $1\frac{73}{102}$. 22. $\frac{5}{11}$.
23. $\frac{91}{115}$. 24. 12. 25. $1\frac{34}{55}$. 26. $\frac{1}{2}$. 27. $\frac{67}{203}$. 28. 1. 29. $\frac{9}{44}$.
30. $\frac{1}{17}$.

Exercise. Page 66. 1. 792 mi. 2. \$2070. 3. 990 sheep. 4. 24
ft. long, 18 ft. wide. 5. 253 lbs.

Exercise. Page 66. 1. 360 2. \$21,908. 3. \$126.80. 4. 35
days. 5. \$84.50. 6. \$8000. 7. \$1750. 8. \$15.50. 9. \$16.86⁵/₃₂.
10. $1\frac{1}{80}$ mi.

Exercise. Page 67. 1. $\frac{1}{40}$. 2. $23\frac{1}{3}$. 3. $3\frac{7}{8}$. 4. $21\frac{3}{8}$. 5. $1\frac{2}{5}$. 6. 0.
7. $\frac{77}{144}$. 8. $\frac{139}{300}$. 9. 19. 10. 7. 11. $\frac{3}{4}$. 12. $1\frac{23}{30}$.

Exercise. Page 67. 1. \$13.50. 2. \$29.30³/₈. 3. Wife \$17,600.
daughter \$5500. 4. \$1667.25. 5. \$4000. 6. \$278.88²¹/₃₂. 7. 405 ac.;
270 ac. wheat; 90 ac. oats; 30 ac. barley. 8. \$16.14³/₄. 9. \$5.38.
10. \$3822.62½. 11. Seed cost \$104¹/₈, crop worth \$1512½. 12. $\frac{1}{3}$, \$306.25.
13. \$5.32½. 14. $18\frac{327}{400}$ in. 15. \$2000. ²/₃

Exercise. Page 69. 1. 82944 lbs.; \$2460.67. 2. $3055\frac{5}{8}$ loads; \$333.33 $\frac{1}{3}$. 3. 90,000 gallons. 4. \$36.75. 5. 160 acres. 6. \$255. 7. \$1196.80. 8. $238\frac{5}{4}$ yd.; $132\frac{3}{8}$ yd.; $105\frac{5}{8}$ yd. 9. $40\frac{1}{2}$ tons; \$688.50. 10. \$15,733.

Exercise. Page 77. 1. 40 rods. 2. 1218.75 lbs. 3. 1396.648 bu. 4. 9.43 hours. 5. 428.509 lbs.; \$201.399606. 6. \$28.18. 7. 918 gallons. 8. 3.405 lbs. 9. 96.89 miles. 10. 9221.4 bushels.

Exercise. Page 78. 1. 1675 bu. wheat, 3600 bu. oats. 2. 110 yards. 3. 0.109. 4. 8.947 hours. 5. 3.433 lbs. 6. 21.8375 miles per hr.; 18.96 knots per hr. 7. \$155.76. 8. 9 mi. per hr. 9. 3.23 tons per acre; \$1534.25. 10. \$513.31 $\frac{1}{2}$.

Exercise. Page 80. 1. \$96.90415. 2. \$4.40703. 3. \$2.54127. 4. \$109.84248. 5. 4.75 cents per mi. 6. 27.3 mi. per hr. 7. \$112.4705. 8. \$571.952. 9. 48.4 mi.; \$1.6698. 10. \$1352.99.

Exercise. Page 81. 1. \$181.05. 2. 4.44 inches. 3. \$1028.24. 4. Taking 52 weeks in yr. 1910—\$581.308; 1917—\$814.996. Difference \$233.688. 5. (a) 3,729,494.9 sq. mi.; (b) 7,206,643; (c) P.E.I. 42.9; N.S. 22.9; N. B. 12.5; Que. 5.66; Ont. 9.67; Man. 6.18; Sask. 1.95; Alta. 1.46; B.C. 1.1; Yukon 0.041; N.W.T. 0.0096; (d) 1.93. 6. (a) 1742.7 mi.; (b) \$60.12315. 7. \$9.853704. 8. 6261.75 tons. 9. 302 hours 42.5 min. 10. 17 days 18.17 hrs.

Exercise. Page 88. 1. 1125 bu. 2. 15. 3. 105. 4. \$1020. 5. 240 ac.; 32 ac.; 48 ac.; 15%. 6. Wh. 216, bar. 96, rye 72, oats 96, oats 20%. 7. For. 73,350, Can. 39,120, Br. 9780. 8. Br. 148,888, U.S. 136,816, others 116,696. 9. Br. \$748,394,249.20, U.S. \$276,330,184.32, Others \$126,651,334.48. 10. B.C. \$21,447,938.04, N.S. \$14,647,372.32, N.B. \$6,277,445.28, Others \$9,939,288.36.

Exercise. Page 92. 1. $33\frac{1}{3}\%$. 2. $66\frac{2}{3}\%$. 3. 87%. 4. 4.35%. 5. 28%. 6. 29.31%. 7. 27.81%. 8. Country 54.47%; city 45.53%. 9. 40.90%. 10. (1) 55.28%, (2) 9.73%, (3) 8.18%.

Exercise. Page 93. 1. \$1600. 2. 14.83%. 3. Rur. 48.37%, Graded 51.63%. 4. 81.71%. 5. (a) \$50.10; (b) \$18.78 $\frac{1}{4}$; (c) \$31.31 $\frac{1}{4}$; (d) \$25.05. 6. 38.46%. 7. (a) 98.97%; (b) .26%; (c) .77%. 8. Can. 10.43%, U.S. 29.03%, India 16.92%. 9. Man. 10.93%; Sask. 10.04%; Alta. 8.33%; B.C. 24.24%. 10. 8.26%.

Exercise. Page 94. 1. (1) 2973.9381 lbs. (2) \$1457.23. 2. \$13,625.28 3. (1) 18.75%, (2) 32.5%, (3) 10.41%, (4) 25%.

4. N. 10867.2 lbs., Ph. 4075.2 lbs., Pot. 2716.8 lbs. 5. (1) \$727.43,
 (2) \$886.78, (3) 23.08%. 6. (1) 1916, 388,387; (2) 1917, 413,323,
 (3) Man. 2.68%; (4) Sask. 10.46%; (5) Alta. 8.59%; (6) B.C. .79%;
 (7) 6.42%. 7. Br. 32.81%, U.S. 29.48%, Fr. 2.44%, Jap. 2.48%, Nor.
 13.89%, S.Am. 9.57%. 8. 55.81%. 9. Gold 7.73%, silver 6.12%,
 copp. 43.33%, coal 28.88%. 10. 1918, 3000 bu.; 1919, 3750 bu.

- Exercise. Page 97. 1. 72,126. 2. 55, 66, 77. 3. 684, 576.
 4. \$125, \$225, \$150. 5. \$150, \$200, \$250. 6. 120, 140, 280.
 7. 61, 122, 183, 244, 305. 8. 450, 600, 765. 9. 153 bu., 170 bu., 187 bu.
 10. 525 bu., 350 bu. 11. 36 boys.

- Exercise. Page 98. 1. A \$750, B \$500. 2. A \$60, B \$144, C \$96.
 3. S. \$3900, W. \$4800, D. \$3300. 4. A \$14.40, B \$9.60. 5. A \$6.30,
 B \$5.25, C \$4.20. 6. A \$10,920, B \$5460. 7. A \$1080, B \$1260,
 C \$1440, D \$1620. 8. \$13,275. 9. \$1765.
 10. B's prof. \$87, C invests \$320. 11. A \$350, B \$210, C \$280.
 12. A \$2333 $\frac{1}{3}$, B \$2500, C \$2666 $\frac{2}{3}$. 13. Water 72 gals, wine 288 gals.
 14. A \$2662, B \$2420, C \$2200, D \$2000. 15. A 540 pages, B 360 pages,
 C 485 pages. 16. A \$1575, B \$1125, C \$2025. 17. A \$24, B \$9, C \$5.

- Exercise. Page 100. 1. A \$369.20, B \$563.80, C \$184.60. 2. A
 80 yds., B 15 yds., C 60 yds. 3. (1) 12, (2) 16, (3) 9. 4. Silks 63 yd.,
 tweed 82 yd. 5. Wheat 69c bu. 6. 14 ten c. 12 five c.
 7. 12 men. 8. $112\frac{1}{2}$, $337\frac{1}{2}$, $562\frac{1}{2}$. 9. 30 cows. 10. A 26 bu., B $19\frac{1}{2}$ bu.
 9 10 12

- Exercise. Page 102. 1. (a) 1478, $295\frac{3}{5}$, (b) $28\frac{23}{40}$, $51\frac{143}{200}$, (c) 31.30, 6.26.
 2. 34. 3. (a) 3010 ft., (b) $3656\frac{2}{3}$ ft., (c) $1408\frac{1}{4}$ ft. 4. 28.72.
 5. 73.5. 6. $14\frac{1}{2}$ lbs. 7. 111 lbs. 8. 14 ft. 10 in. 9. $1608\frac{1}{4}$ lbs.
 10. 9. 11. 15,602 ft. 12. 65c. 13. $\$2.06\frac{1}{4}$. 14. 43.9925° .
 15. 27 ft. 6 in.; 4 ft. 7 in. 16. 40c. 17. \$12 per acre. 18. \$42.50.

- Exercise. Page 106. 1. 375 lbs. 2. 44.625 ft. 3. 273 bu.
 4. \$16. 5. \$720. 6. \$70. 7. $3\frac{1}{3}$ days. 8. $\$1\frac{3}{32}$. 9. 150 men.
 10. \$12187.50. 11. 288 mi. 12. 34 lbs. 13. \$25.

- Exercise. Page 107. 1. Profit, \$143.65; gain, 25%. 2. $8\frac{8}{9}$ days.
 3. 20, 40, 60. 4. $3\frac{1}{18}$ days. 5. 2880 bd. ft. 6. 379,540. 7. $\$5484.37\frac{1}{2}$.
 8. $\frac{5}{7}$. 9. $\$6.37\frac{7}{64}$. 10. 999.99475. 11. $\$29\frac{1}{8}$, $\$33\frac{5}{8}$. 12. 87357. 13. $5\frac{7}{5}$.

- Exercise. Page 111. 1. \$229.80. 2. \$66.00. 3. \$360.00.
 4. \$380.00. 5. \$1026.00. 6. First by \$6.00. 7. \$12.75.

- Exercise. Page 114. 1. $32\frac{1}{2}\%$. 2. \$25. 3. \$2700, \$2565.
 4. $28\frac{1}{4}\%$. 5. $35\frac{7}{8}\%$. 6. 25%. 7. \$250. 8. \$85.
 9. \$12.50.

Exercise.	Page 117.	1. $33\frac{1}{3}\%$.	2. 125%.	3. \$90.
4. \$7 $\frac{1}{3}$.	5. \$2885.	6. $3\frac{1}{3}\%$.	7. 20%.	8. $41\frac{3}{7}\%$.
9. 45c.	10. $33\frac{1}{3}\%$	11. \$21.60; 12%.	12. 60%.	

Exercise.	Page 118.	1. \$20; 40%.	2. \$5.00	3. 128 $\frac{4}{5}$.
4. \$24.00.	5. \$10.00.	6. \$7.00.	7. \$49087.50	8. 50%; 4500

Exercise.	Page 122.	1. \$600, \$3400.	2. \$166.25.	3. \$120, \$29.25
4. \$750.	5. \$20.25.	6. \$7987.50.	7. \$3264.57.	8. \$750.

Exercise.	Page 123.	1. 6%.	2. 2%.	3. 3%.	4. \$1687.50;
\$562.50.	5. \$110.	6. 5%.	7. \$187.50		

Exercise.	Page 127.	1. \$36.	2. \$21.75.	3. \$69.60.
4. \$318.50; \$7318.50; \$18681.50.		5. \$192.	6. $\frac{3}{5}\%$; \$6; $\frac{1}{5}\%$.	
7. \$78,670; \$21,330.		8. \$68.85.		

Exercise.	Page 128.	1. \$15.	2. \$295; \$1410.	3. \$24,908.40;
\$373.63.	4. \$1.50.	5. $1\frac{1}{2}\%$.	6. $1\frac{1}{3}\%$.	7. \$1575.

Exercise.	Page 133.	1. $2\frac{1}{2}\%$; 25 mills; \$175.	2. \$52.80	
3. \$810.	4. 2%.	5. 3.75 mills.	6. \$921.60.	7. \$24.00
8. \$30; \$3470.				

Exercise.	Page 134.	1. \$330,000.	2. \$600,000.	3. \$304,000.
4. \$3250.	5. \$30.	6. \$13,230.	7. \$10 increase.	8. \$55
a month.				

Exercise.	Page 135.	1. \$10,800.	2. \$612.50.	3. \$73.92.
4. \$690.	5. \$2.	6. 2000 lbs.	7. \$2205.	8. 35%.
9. \$1200.	10. \$3690.			

Exercise.	Page 138.	1. \$55.	2. \$54.60.	3. \$180.
4. \$236.41.	5. \$808.97.	6. \$163.80.	7. \$82.	8. \$148.36.
9. \$187.50.	10. \$206.10.	11. \$177.80.	12. \$568.05.	
13. \$451.50.	14. Bank gains \$65.	15. \$14.96.	16. \$215.75.	
17. \$19.53.	18. \$182.46.	19. \$387.62.		

Exercise.	Page 139.	1. \$1887.60.	2. \$882.	3. \$934.92.
4. \$960.84.	5. \$253.50.	6. \$1336.80.	7. \$851.68.	
8. Buying the house by \$32.				

Exercise.	Page 140.	1. 8%.	2. 6%.	3. 8%.	4. $7\frac{1}{2}\%$.
5. 8%.	6. 6%.	7. \$17.50.	8. 7%.	9. 3%.	10. 15%.

Exercise. Page 142. 1. 3 yrs. 2. $2\frac{1}{4}$ yrs. 3. 5 months.
 4. $2\frac{1}{2}$ yrs. 5. 16 yrs., 8 mos. 6. (20; 25; $12\frac{1}{2}$; 10) yrs.
 7. November 11th, 1920.

Exercise. Page 142. 1. (a) \$2000.00; (b) \$1875.00; (c) \$2500.00;
 (d) \$4000.00 2. \$3500.00. 3. \$20,000.00. 4. \$32,500.00

Exercise. Page 143. 1. (a) \$360.00; (b) \$655.00; (c) \$750.00;
 (d) \$1,825.00 2. Prin. \$240.00 Rate 8%.

Exercise. Page 145. 1. \$685.49; June 5th. 2. Dec. 9th; \$671.90.
 3. Oct. 28th; \$662.76. 4. Dec. 6th; \$407.17. 5. Nov. 7th; \$749.51.

Exercise. Page 146. 1. \$19.12. 2. \$9.16. 3. \$700.00.
 4. \$15.67. ✓ 5. \$392.40. ✓ 6. \$17.40. 7. \$35.20. 8. \$81.67.
 9. \$881.22. 10. \$563.50.

Exercise. Page 147. 1. (a) May 15th (1909, '10, '11, '12) (b)
 \$155.00; \$147.50; \$140.00; \$132.50; (c) \$575. 2. (a) 10 years; (b) (1)
 \$252.00; (2) \$240.80; (3) \$229.60; (4) \$218.40; (5) \$207.20; (6) \$196.00;
 (7) \$184.80; (8) \$173.60; (9) \$162.40; (10) \$151.20; (c) \$616.00. 3. (a)
 April 1st (1913, '14, '15, '16, '17, '18, '19, '20, '21, '22); (b) \$186.00; \$179.40;
 \$172.80; \$166.20; \$159.60; \$153.00; \$146.40; \$139.80; \$133.20; \$126.60;
 (c) \$363.00. 4. (a) \$222.00; \$213.00; \$204.00; \$195.00; \$186.00; \$177.00;
 \$168.00; \$159.00; (b) \$324.00.

Date of Payment	Principal	Interest	Amount
5. (a) Apr. 1, 1914	\$100	\$60	\$160
" " 1915	100	54	154
" " 1916	100	48	148
" " 1917	100	42	142
" " 1918	100	36	136
" " 1919	100	30	130
" " 1920	100	24	124
" " 1921	100	18	118
" " 1922	100	12	112
" " 1923	100	6	106

(b) \$1330.00.

Date of payment		Principal	Interest	Amount
6.	(a) March 15, 1914	\$800 + \$720 = \$1520		
	" " 1915	\$800 + \$672 = \$1472		
	" " 1916	\$800 + \$624 = \$1424		
	" " 1917	\$800 + \$576 = \$1376		
	" " 1918	\$800 + \$528 = \$1328		
	" " 1919	\$800 + \$480 = \$1280		
	" " 1920	\$800 + \$432 = \$1232		
	" " 1921	\$800 + \$384 = \$1184		
	" " 1922	\$800 + \$336 = \$1136		
	" " 1923	\$800 + \$288 = \$1088		
	" " 1924	\$800 + \$240 = \$1040		
	" " 1925	\$800 + \$192 = \$ 992		
	" " 1926	\$800 + \$144 = \$ 944		
	" " 1927	\$800 + \$ 96 = \$ 896		
	" " 1928	\$800 + \$ 48 = \$ 848		

(b)

\$17760

7. (a) April 15, 1903; \$106.00.

Exercise. Page 151. 1. \$200.07. 2. \$332.46. 4. \$407.38.
6. \$848.37.

Exercise. Page 153. 1. Int. \$102.50. Amt. \$1102.50. 2. Int.
\$177.54. Amt. \$2977.54. 3. Int. \$312.16. Amt. \$2812.16.
4. Diff. \$11.02. 5. Diff. \$3.02. 6. Diff. \$6.08. 7. \$121.16.
8. \$6.90. 9. \$466.56. 10. \$129.86. 11. \$541.22.
12. \$210.26.

Exercise. Page 157.

Date of Maturity	Term of Disc't	Discount	Proceeds of Note
1. July 24, 1919	80 days	\$6.58	\$493.42
2. Jan. 18, 1920	125 "	\$9.59	\$390.41
3. Mar. 29, 1919	43 "	\$6.19	\$650.81
4. Nov. 14, 1919	106 "	\$8.90	\$502.10
6. They are equal; Lower rate of Int. 8.11%			7. \$740.26 8. \$1322.48
9. \$15.17; \$568.83		10. \$891.12.	

Exercise. Page 158.

Discount	Proceeds	
1. \$2.40	\$403.72	8. \$800.
2. \$2.13	\$250.00	9. \$500
3. \$7.32	\$751.89	10. $22\frac{1}{6}\%$.
4. \$9.97	\$1000.44	11. 146 days.
5. \$33.55	\$1191.11	12. \$1390.24
6. \$763.40		13. \$419.13.
7. Dec. 13, 1919; \$627.42; \$1227.42; \$1207.34.		14. \$454.14.

Exercise. Page 162. 1. Exchange \$3.75.

Exercise. Page 162. 1. $\frac{63}{200}$ or $31\frac{1}{2}\%$; \$22,000.00. 2. \$4800.

3. \$14,400; \$9000. 4. \$450. 6. \$4000. 7. \$1980.
8. Lost \$240.00. 9. \$2430. 10. \$1500.00.

Exercise. Page 163. 1. \$72.00. 2. 16 mills; \$315.20.
3. \$29,000. 4. $32\frac{1}{2}\%$. 5. $2\frac{1}{2}\%$. 6. \$591.72; \$1491.72.
7. $6\frac{3}{4}\%$. 8. 5%, 2%. 9. 16 mills. 10. 13%.

Exercise. Page 165. 1. \$100.32. 2. \$176.00. 3. \$600.
4. \$1791.70. 5. \$42.18. 6. \$135.60. 7. $4\frac{1}{2}$ bush.
8. \$320.00. 9. 55c. 10. $8\frac{1}{3}\%$.

Exercise. Page 166. 1. $1\frac{1}{2}\%$. 2. \$35.00. 3. \$862.50.
4. \$2.47 $\frac{1}{2}$. 5. Loss $6\frac{1}{4}\%$. 6. \$1080.00. 8. The 70-day note
by \$1.00. 9. \$5000.00. 10. \$36.00.

Exercise. Page 177. 1. 160 rd. 2. 1280 rd. 3. 176 yd.
4. \$720. 5. 960 ft. 6. \$134.64. 7. 1462. 8. \$225.40.

Exercise. Page 182. 1. 30 sq. ft. 2. \$.25. 3. \$396.
4. \$1584. 5. 132 trees. 6. 19,800 blocks. 7. 78 tons.
8. 1280 bushels. 9. 80 rds. x 20 rds. 10. 2560 acres.
11. 12 acres.

Exercise. Page 183. 1. $18\frac{1}{2}$ ft. x 37 ft. 2. \$13.20. 3. 200 rds.
4. 10 yrs. 5. \$23.409. 6. 12,130,560 acres. 7. 15,360 acres.
8. \$320.64. 9. \$132. 10. \$96.88 $\frac{2}{3}$.

Exercise. Page 186. 1. $8\frac{1}{3}$ sq. ft.; 399.9125 sq. chs.; 1014.48 sq. rds.
2. 18 acres. 3. 32 ft. 4. 16 ins.

Exercise. Page 187. 1. 88 sq. ins. 2. 30 acres. 3. 33 B. ft.
4. \$975.

Exercise. Page 190. 1. 63 sq. ins. 2. 9 acres. 3. 9 ins.
4. 4. 5. $42\frac{1}{4}$ sq. yds.; $56\frac{2}{3}$ sq. yds.; $2\frac{3}{4}$ sq. chs. 6. 15 ft.;
220 yds.; 2125 links.

Exercise. Page 193. 1. 37 ft. 2. 61 ft. 10 ins. 3. 650 ft.
 4. 77 ft. 5. 44 ft. 6. 70 chs. 7. 4 ft. 8. 390 yds.
 9. 3 rds. 2 yds. 6 ins. 10. 4 chs. 80 links. 11. 61105 sq. in.

Exercise. Page 193. 1. 40 ft. 2. 20 ft. 3. 13 ft.
 4. 96 ft. 5. 193 ft. 6. 114 ft. 7. 4 ft. 8. 34 ft.
 9. \$487.20. 10. 85 ft. 11. 2 yds. 3 ins.

Exercise. Page 195. 1. 110 ft. 2. 286 chs. 3. 14 yds. 2 ft.
 4. 6 rds. 5. 11 chs. 6. 24 chs. 64 links. 7. $62\frac{9}{7}$ ft.
 8. 14 chs. 96 links. 9. 17 yds. 4 ins. 10. 14 ins. 11. 3 ft. $2\frac{1}{2}$ in.
 12. 2 ft. 11 ins. 13. 7 ft. 14. 1120 ft. 15. 4.9 mi.
 16. 20 rds. 2 yds. 17. 1 ch. 71.5 links. 18. 23 yds. 1 ft.
 19. $150\frac{9}{7}$ ins. 20. 14 ins. 21. \$158.40. 22. 8.

Exercise. Page 197. 1. 5544 sq. ins. 2. 7546 sq. yds.
 3. 24062.5 sq. yds. 4. 13898.5 sq. yds. 5. 18.32985 sq. chs.
 6. 1386 sq. yds. 7. $471\frac{5}{8}$ sq. ins. 8. 647.185 sq. chs.
 9. 3850 sq. yds. 10. $21\frac{3}{2}$ sq. yds. 11. $17796\frac{5}{8}$ sq. links.
 12. $50\frac{1}{1}$ acres. 13. 38.5 sq. ft. 14. 180 sq. ft. 106 sq. ins.
 15. 15.4 acres. 16. 9.625 sq. rds. 17. 11 sq. rds. 13 sq. yds.
 6 sq. ft. 108 sq. ins. 18. 385 acres.

Exercise. Page 197. 1. $176\frac{1}{4}$ sq. yds. 2. $50\frac{1}{11}$ acres.
 3. $150\frac{9}{7}$ ft. 4. 25 rds. 5. 17 ins. 6. \$1013.76.
 7. 77 sq. ins. 8. 55 ins.; 71.5 ins.; 88 ins.; 99 ins. 9. 62.04 yds.
 10. 3.863 sq. ft. 11. 16.5 ft.

Exercise. Page 199. 1. 121.5 sq. ins.; $91\frac{1}{8}$ cub ins. 2. 89.5 sq.
 ins.; 52.5 cu. ins. 3. 138 sq. ins.; 87.75 cu. ins. 4. 216.
 5. 320 sq. ins. 6. 14 ft., 8.4 ins. 7. 1 cu. ft. 469 cu. ins.
 8. $\frac{5}{258}$ ins. 9. 16 ft. 8 ins. 10. 1 ft. 9.9 ins. 11. 2.4 ft.

Exercise. Page 199. 1. 36 ft. 2. $6\frac{1}{4}$ ft. 3. $1107\frac{2}{3}\frac{3}{8}$ gals.
 4. 10 ins. 5. 8640. 6. $4\frac{4}{8}$ ft. 7. $3\frac{1}{8}$ ft. 8. 18 ft.
 9. $\frac{1}{15}$ ins. 10. $5\frac{5}{7}$ ft. 11. 2.2575 tons. 12. 500 loads.

Exercise. Page 202. 1. 14 ins. 2. 66000 sq. ft. 3. 6600.
 4. \$24.75. 5. 1 ft. 4 in. 6. $19\frac{1}{4}$ ins. 7. 6912. 8. \$220.
 9. 3019.5 lb. 10. $212\frac{1}{7}$ cu. ft.

Exercise. Page 203. 1. $3\frac{3}{4}$ sq. ft. 2. 7 sq. ins. 3. $35\frac{1}{18}$ tons.
 4. $282\frac{5}{8}$ cu. ft. 5. 57012.857 cu. ft. 6. 12305.7 tons.
 7. \$303. 8. 186.962 bushels. 9. 12,031,250 gals. 10. 80 ft.
 11. 916.5 sq. ft. 12. 16.85 ft. 13. 1452 sq. ft. 14. 7.071 ft.
 15. 43.09 ft. 16. \$18. 17. 3456. 18. 490 B. ft.
 19. 894.97 gals. 20. \$87.50. 21. $183\frac{1}{3}$ sq. ft. 22. $75796\frac{7}{8}$.

- gals. 23. $37\frac{7}{8}$ in.; .1048 in. 24 18 ft. 25. circle by 33 sq. ft.
 26. \$519.75. 27. 229.259 mi. 28. \$62.40. 29. 4 ft.
 30. \$56. 31. $36\frac{3}{4}$ sq. yds. 32. 1 hr. 20 mins.; 2.663 acres;
 462.4 acres. 33. \$24. 34. \$33.00 35. \$48.00; \$57.60.
 36. \$255.64. 37. \$71.215, 38. 996 B. ft. 39. 268 sq. ft.

- Exercise. Pages 210. 4. (a) 1595012.948 m., (b) 862.05 mi.
 .00083 m., (c) 365.6 m.; 391.94 m. 5. \$272.1875. 6. \$1,801,325.;
 7. 7.6375 miles. 8. 4800 km. 9. $13\frac{1}{2}$ m. 10. $\frac{3}{4000}$. 11. 83 km.
 7 Hm. 1 Dm. 1 m. 8 dm. 12. 257 francs.

- Exercise. Page 212. 3. \$155,163.648; 1 H.A., 1 A., 1.8 c A.
 4. 12.4575 sq. mi. 5. 2.92 sq. m. 7. 2352.25 sq. m. 8. 111.0928 sq. m.
 9. 28.8 metres. 10. 100 m. 11. 4650000.

- Exercise. Pages 213. 3. 1219.24940201 cu. m.; 1219249.40201
 cu. dm. 4. $175\frac{1}{2}$ steres. 5. \$35.75. 6. 907.2 litres. 8. \$1.008.
 9. 0.8096 cu. m. 10. 100.

- Exercise. Page 216. 1. 6.21 miles. 2. \$153. 3. \$64.94.
 4. 61800. 5. $27\frac{7}{9}$ cm. 6. 302400 kgms. 7. 38.4 kgms. 8. 1.75
 9. 1400. 10. 119.68 cu. m.

- Exercise. Page 217. 1. 27 to 25. 2. 49.5 ares. 3. 1166 cm.;
 108146.5 sq. cm. 4. \$125.71. 6. 19.68 litres. 7. 2.76 litres
 8. 189.4. 9. 3.9 kgms. 10. 375 kgm. 11. 3,375,000 kgms.

- Exercise. Page 219. 1. 42.3 T. 2. 2940 lbs. 3. $\frac{55}{224}$
 4. $151\frac{1}{2}\frac{2}{7}$ cu ft. 5. \$75 each. 6. \$18,600. 7. $8\frac{1}{3}\%$.
 8. 2nd invest., \$146.40. 9. \$14,231.90. 10. 45.7c. 11. \$6 loss.
 12. \$3812.44. 13. 510.40. 14. 480 rd. 15. 80 ft.
 16. \$130.69. 17. \$2870. 18. (a) Sept. 19, (b) \$855.99.
 19. $3579\frac{6}{11}$ T. 20. $12\frac{2}{13}\%$.

- Exercise. Page 222. 1. \$27.61. 2. \$1.83. 3. $89\frac{2}{17}\%$.
 4. \$144. 5. \$734.71. 6. \$78.04. 7. 7.7 acres. 8. \$10.26.
 9. \$721.17. 10. $5\frac{1}{2}\frac{5}{8}\%$. 11. \$750, \$1050, \$900. 12. \$6.
 13. 24 ft. 14. \$7475. 15. $11\frac{5}{11}$ ft. 16. \$32.92.
 17. 1,815,000 gal. 18. 8. 19. \$493.50. 20. \$3606.95,
 \$3570.88.

- Exercise. Page 225. 1. 1.8 a. 2. \$1018.18. 3. 1500.
 4. \$16112. 5. 9125.92 cu. yds. 6. 11,550 gal. 7. 3277.24.
 8. 2700 cu. ft. 9. .368 cu. in. 10. \$91.00. 11. \$22.20.
 12. $\frac{1}{4}$. 13. 1st .61% daily, 2nd. .432% daily. 14. $28\frac{1}{4}\%$.
 15. 1st boy, \$6875; 2nd boy, \$14,656. 16. 4,181,760 cu. ft. 17. \$1100.
 18. \$188.25. 19. 50%. 20. $66\frac{2}{3}\%$.

Exercise. Page 228. 1. \$2369.80. 2. 37c, 60c, 83c. 3. 85c.,
 \$1.25, \$1.55. 4. 7 ft. 5. \$426.66 $\frac{2}{3}$, \$630.00, \$1536.00.
 6. \$5370.00. 7. \$1.67. 10. \$636.76. 11. Sep. 10, 1919.;
 \$440.30. 12. 232 sq. ft. 13. \$318.00, \$302.40, \$286.80, \$271.20, \$255.60.
 14. \$3962.50. 15. 15.1%. 16. \$1135.14, \$1702.70, \$1362.16.
 17. 120, 130. 18. \$1279. 19. 1192.83, 1023, 90.25%. 20. \$1556.58.

Exercise. Page 232. 1. 43.275%, 66.2%. 2. 7.99, \$69.91.
 3. 720. 4. 127.2 ft. 5. 27.712 sq. in. 6. 5280 sq. ft.
 7. \$3798. 8. Cash; \$19.50. 9. A \$742.42; B \$890.91; C \$763.63.;
 D \$848.49; E \$954.55. A. \$3000; B. \$1050; C \$900. 10. 12 $\frac{1}{4}$ c.
 12. 63030.30 gal. 13. \$2501.70. 14. \$1918.41. 15. 20.72 A.
 16. \$4774, \$4543, \$4312, \$4081. 17. 10%, \$132.50. 18. 38 da.;
 May 26, Mar. 24. 19. \$19,760. 20. \$19959.83.

11

521
85

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 5 \\
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 16
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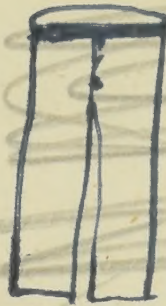
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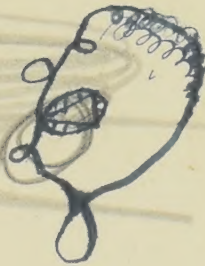
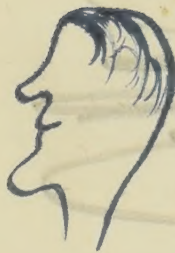
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3



no fool

Les Beaches first
long pants.



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16.5
15.5
11

11
16.5
15.5
11

16.5
15.5
11

24 00

21 25

" Area = $25 \times 40 = 1000$ sq. ft.

" Area = 25×40 sq. ft. = 1000

5

10

12

12

22

22

22

126

14

22

25

126

126

126

